Comparative Analysis of Dispersion Parameter Estimates in Loglinear Modeling

Applied to E-commerce Sales and Customer Data

SENIOR PROJECT

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Abstract

When loglinear models are applied to count data the issue of over-dispersion often arises. Moment and maximum likelihood estimation methods in accounting for over-dispersion are widely used because they allow for model checking tools such as Chi-square, F, and likelihood ratio tests. Herein is a comparison between R functions that each uses one method; glm.nb uses MLE, and glm.poisson.disp uses MME. The Index of Dissimilarity and visual model selection (ECDF plots) are also incorporated. These are applied to sales data using product and customer information compiled over the last five years that was generously provided by an e-commerce company.

Contents

1. Introduction

For data that is well represented in a contingency table, by a table of counts, or where there is not a distinct response variable, loglinear modeling is commonly employed to describe the direction and magnitude of association between variables (Agresti 2007, Venables & Ripley 2002, McCullagh & Nelder 1989**)**. It is especially useful for higher-order models or when the variables have many levels. All of the above describe the data analyzed herein. See Jansakul and Hinde for a listing field application and authors.

These data are sales data provided by an e-commerce company and include a wide variety of products with mass appeal. As such, the sales frequencies for the many combinations of covariates can be vastly different from one another. Such large differences make it difficult to account for the variance between different covariate combinations. From the Comprehensive R Archive Network (CRAN, http://CRAN.R-project.org/) comes two functions used to model such data: `glm.poisson.disp()` (in dispmod; Luca Scrucca 2012, Breslow, N.E. 1984) and `glm.nb()` (in MASS; Venables, W. N. and Ripley, B. D. 2002). While both model the data in valid ways— `glm.poisson.disp()` using a Method of Moment (MM) estimator of the parameters, and `glm.nb()` using Maximum Likelihood (ML)—and fit this data very well, they often give opposing directions of association for covariate combinations. This paper briefly discusses the effect on the model from using both R functions and the implications on inference if one is chosen in lieu of another. In addition, results for the main research questions pertinent to the company whose data are used are addressed in depth.

The layout of the paper begins with a description of how the project came about, the data and methods used with a description of the R functions used and a brief of over-dispersion, followed up with a section on model fitting, a discussion of some issues encountered, the results of the sales data, and the summary.

2. Background

In proposing the use of these data for this project, two areas of interest arose. The main question of interest centered on what may influence how long an item stays in inventory of the company. Another aim was to measure how, and in what way, the variables related to one another.

However, these data restricted direct analysis of this question because of the way "avg days in inv" is calculated. It is an average of the days in inventory for all of the items of a specific type received by the warehouse for any of the drops to the warehouse (a *drop* occurs twice a day and is when the system that processes orders releases them to the warehouse for fulfillment). As such, this value may incorporate storage time from different/multiple supplier shipments to the warehouse. Also, without distinction for items that are drop shipped or pre-sale (put on sale before being received to the warehouse), there is no clear way to distinguish in this analysis and beyond summary statistics if, or in what way, the average days in inventory is affected by the characteristics of products or customers. Also, with respect to storage time, because the data do not make distinctions among unique customers, there is no way to analyze differences between specific combinations of customer characteristics related to particular products. Thus, any interpretations of results from such an investigation may be spurious. However, what was able to be addressed was the strength and direction of associations between a selected subset of variables.

3. Data & Methods

3.1 The Data

The original data file contained 1,186,929 observations. Each observation contains up to 25 variable descriptions. From this file, SAS 9.2 was used for data management, reducing the number of variables to six whose unique non-zero combinations were counted and exported using PROC SQL with analysis carried out using R 2.11.1. There are 2,490 such combinations whose frequencies are studied.

Below are the descriptions of the variable of interest. Each product manufacturer is listed under Brand. Channel refers to the sales channel that the product is sold through. A*gg_channel* is comprised of Club CPO: Phone, Club CPO: Web, Other, Outlets: Phone, Outlets: Web, Press.Wash: Phone, Press.Wash: Web, Reconditioned Tools: Web, Reconditioned Tools: Phone, Tool Crib: Phone, Tool Crib: Web, and Wholesale. A customer's gender is given by Sex, and the original levels were aggregated as follows: *unknown* and *ambiguous* as Unknown; *female* and *probably female* as Female; *male* and *probably male* as Male. A product's sales condition is either New or Reconditioned. The descriptions for a tool being cordless or corded are obvious.

Brand	Black & Decker	Fein	Makita	Powermatic	Bosch (Ref level)	Festool	Metabo
	Ridgid	Bostitch	Homelite	Milwaukee	Ryobi	Campbell Hausfeld	Jet
	Panasonic	Senco	Delta	Karcher	Porter Cable	Skil	Dewalt
Channel	agg_channel	Branded Web (Ref level)	Phone	Amazon Sales	eBay Sales		
Sex	Unknown	Female	Male (Ref level)				
Income	High ($75k- 200k+)	Middle ($30k-75k) (Ref level)	Low (-$10k-20k)				
Cordless	Cordless (Ref level)	Not Cordless					
Condition	New (Ref level)	Reconditioned					

Table 1. Listing of variable names and levels.

3.2 Methods

For data that is well represented in contingency tables, loglinear modeling may be employed as a way to assess associations between any, or all, of the variables under consideration. Loglinear models extend inference beyond 2-way contingency tables to multi-way tables where the conditional relationship between two or more discrete, categorical variables is analyzed by taking the natural logarithm of the cell

frequencies. It allows for interpretations of the strength and direction of relationships in these tables. What is being modeled is the estimated *effect* on the frequency by unique groupings as shown by the strength of the association between one or more variables in each group. As is the case in this analysis where we have multiple two-variable interactions, the association between any two variables, given some fixed level of the other four variables, has either a positive or negative effect on the expected number of times this unique grouping appears in the data set. It may also be said that the effect on the estimated cell frequency of one customer-product specification is ***x***-times higher or lower when compared to the reference group. Often, due to the complexity of interpretations or relevance, only one variable level at a time will be adjusted. For instance, to compare different brands the remaining five variable levels will remain the same for both brands; given these fixed levels, Brand A is associated with an increase (decrease) in the estimated odds of a sale compared to Brand B.

The Poisson distribution assumes the mean and variance of the response are equal. The extra-variation, referred to as extra-dispersion (in this case, strictly over-dispersion), inherent in this data violate this assumption. This necessitates the need to estimate a dispersion parameter. Two methods for estimating dispersion were used—`glm.nb` and `glm.poisson.disp`—because it was not clear to me how well either would model the data.

Model selection was based forward/backward stepwise selection and ANOVA process to what difference between the two functions there were and the interactions it deemed important. Stepwise selection for both functions identified the Income by Cordless interaction for removal. ANOVA selection in `glm.nb` further identified the Sex x Cordless for removal. For comparative purposes the stepwise selections were used.

The models estimated excluded the interaction between a person's income and whether or not an item was cordless. This exclusion implies conditional independence between these two variables given the other variables, meaning that the association between the two variables does not depend on any others (Agresti 2007). The interactions included in both models are:

Brand : Channel	Channel : Income	Cordless : Condition
Brand : Income	Channel : Sex	Income : Sex
Brand : Sex	Channel : Cordless	Income : Condition
Brand : Cordless	Channel : Condition	Sex : Cordless
Brand : Condition		Sex : Condition

Table 2. 2-Way interactions included in both models.

Since there are a prohibitive number of model parameters to express in an example of the model equation, the general form for loglinear models is given next:

$$log\mu_{ij} = \lambda + \lambda_i^A + \lambda_j^B + \lambda_{ij}^{AB}, or$$

$$log(f_i) = \beta_0 + \beta_1 x_{1i} + \cdots = \boldsymbol{\beta}^T \boldsymbol{x_i}$$

where μ_{ij} is the mean response of the effect λ_{ij} for covariates A and B, and where f_i is the estimated frequency of the mean response $\boldsymbol{\beta}^T \boldsymbol{x_i}$, where $\boldsymbol{x}$ is the and $\boldsymbol{\beta}$ are the usual linear predictors.

3.3 Functions

`glm.nb`

This function uses an iteratively weighted least squares algorithm for estimating over-dispersion. A benefit of `glm.nb` is that it defines the variance as a gamma random variable which, in allowing the variance to be quadratic, better accounts for the tremendous variation in the observed data. Taking the Poisson mean as a gamma distributed random variable leads to the NB model and we can obtain a quadratic mean-variance relationship when the shape parameter is held constant and letting the scale parameter vary (Jansakul and Hinde 2002). Thus the negative binomial distribution is known as a Poisson-Gamma mixture (Ma 2011).

For instance, suppose that the random variable Y_i represents frequencies of sales with means θ_i for each combination of covariates in a fixed period of time. Because of the uncertainty in θ, it should itself be regarded as a random variable. The following uses a parameterization given by Hinde and Demétrio 2007: The Poisson-Gamma mixture with $Y_i \sim Poi(\theta_i)$ where $\theta_i \sim Gamma(k, \lambda_i)$ has a negative binomial distribution for the Y_i:

$$f_{Y_i}(y_i|\mu_i, k) = \frac{\Gamma(k + y_i)}{\Gamma(k) y_i!} \frac{\mu_i^{y_i} k^k}{(\mu_i + k)^{k+y_i}}, \quad y_i = 0, 1, \ldots$$

and $\mathbf{E}(Y_i) = k/\lambda_i = \mu_i$ with $V(Y_i) = \mu_i + \mu_i^2/k$.

The estimation of k addresses over-dispersion, and is commonly denoted $\phi = \frac{1}{\theta} = \frac{1}{k}$. Note that by estimating θ rather than ϕ directly guarantees the existence and uniqueness of the likelihood function, allowing $\boldsymbol{\beta}$ to be estimated by maximum likelihood (Aragan 1992).

`glm.poisson.disp`

The author of this function utilized an iterative algorithm that uses a moment method giving the unbiased estimating equation (Breslow 1984)

$$\sum_{i=1}^{n}\left\{\frac{(y_i-\mu_i)^2}{\mu_i\left(1+\frac{\mu_i}{k}\right)}-1\right\}=0.$$

This equates to solving $X^2 = n - p$ where X^2 is the generalized Pearson X^2 statistic. Combining this with weighted Poisson regression, Breslow proposed estimating $\boldsymbol{\beta}$ using the weights, $w_i = 1/(1+\hat{\mu}_i/\hat{k})$, obtained from the previous iteration (Hinde and Demétrio).

3.4 Over-dispersion

Two potential causes of over-dispersion in this data may be that a variable for time and/or a variable for customer location are not considered. Heterogeneity or dependence among clusters of data, whether temporal or spatial, violates the Poisson assumption and can cause over-dispersion **(**Agresti 2007**)**. Figure 1 shows how spread out the data are. The range of sales frequencies is quite broad; there are 154 unique covariate combinations appearing once, and a single unique observation appearing 48,245 times.

The mean of the frequency is 352.5261 with a variance of 2,473,575. While the data clearly violates $E(Y_i) = V(Y_i)$, Table 3 shows vastly different test statistics and similar, though not comparable, estimates of the dispersion parameter ϕ. They are not directly comparable because both models estimated different parameters due to singularities. These model differences are discussed in Section **4.4** and referenced, in part, in the IBM documentation.

Model	Function	Test Stat	p-value	$\tilde{\phi}$ (se)
2-Way Interaction	`glm.poisson.disp`	z = 33.4573	< 2.2e-16	0.18798 (-)
2-Way Interaction	`glm.nb`	½$X^2_{(1)}$ = 38365.1544	< 2.2e-16	0.16107 (0.227)

Table 3. Test of over-dispersion results.

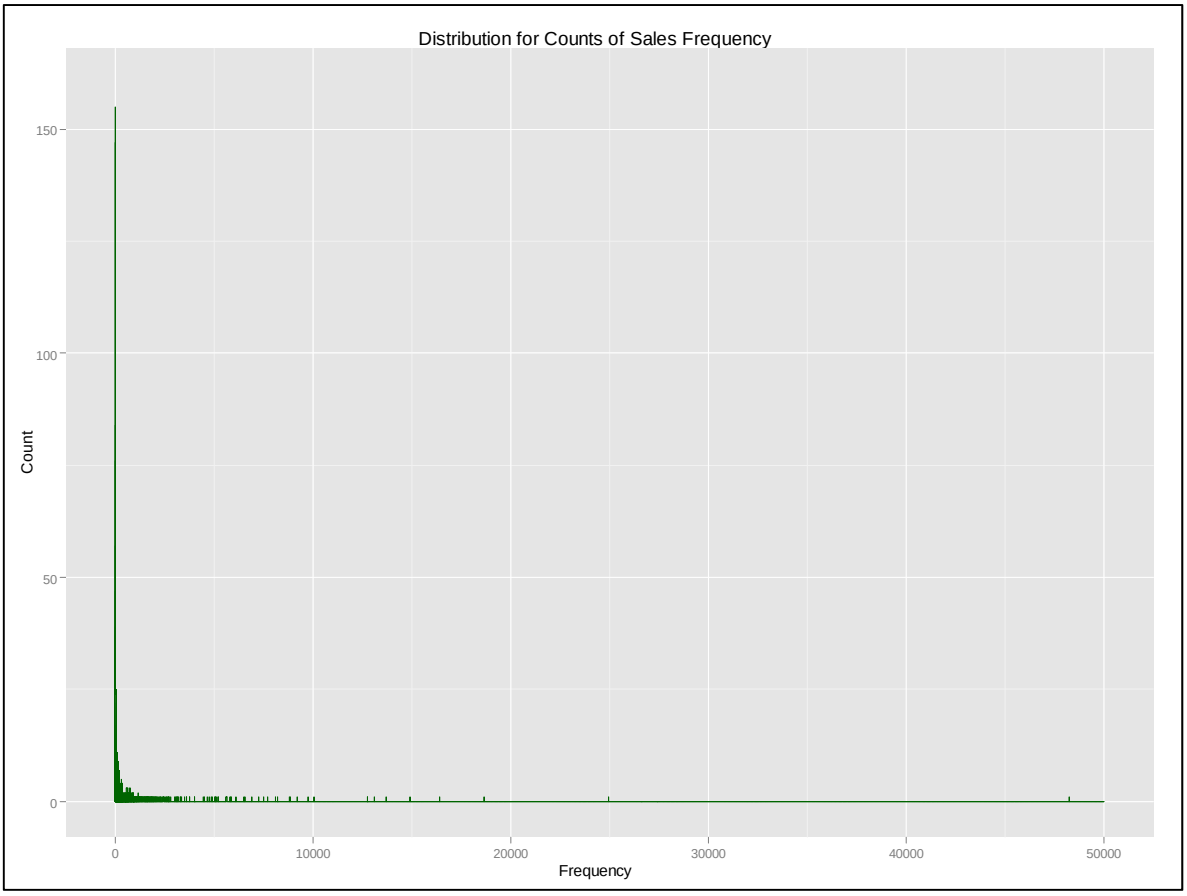

Figure 1. Distribution of counts of covariate frequencies.

4. Model Fit

4.1 Dissimilarity

When checking the fit between models significant differences may be of little use because the large sample size makes goodness-of-fit tests very sensitive in detecting the smallest effects. The Dissimilarity Index (DI) summarizes the closeness of model fit irrespective of sample size. Its summary represents the proportion of observations that need to be moved to create a perfect fit.

For a table of arbitrary dimension with cell counts $\{n_i = np_i\}$ and fitted values $\{\hat{\mu}_i = n\hat{\pi}_i\}$, let

$D = \sum|n_i - \hat{\mu}_i|/2n = \sum|p_i - \hat{\pi}_i|/2$, where D takes values between 0 and 1. Smaller values of D indicate a better fitting model in a more practical sense (Agresti 2007). While this index is well suited for comparing higher and lower order models, in this case it is used to help distinguish differences between

the two functions. For these data, higher order models were either not relevant or significant enough to consider. Table 4 shows that with a lower DI value the MM estimated model is slightly better than the ML model. Also see Kuha and Firth 2010 for more information on the index.

Model	Function	Dissimilarity
2-Way Interaction	`glm.poisson.disp`	0.3514
2-Way Interaction	`glm.nb`	0.3837

Table 4. Dissimilarity index values. Smaller values indicate better fit.

4.2 Visual Model Fit

The moment estimated model has a lower deviance yielding a better, but somewhat heuristic, lack-of-fit statistic (Table 5).

Model	Function	AIC	Deviance	DF	LOF (Dev/df)
All 2-Way Interactions	`glm(...,family=Poisson)`	60971	46682	2230	20.9336
Additive	`glm.poisson.disp`	2520	2026	2459	0.8239
2_Way (Reduced)	**`glm.poisson.disp`**	4602	**2132**	2232	**0.9552**
Additive	`glm.nb`	25924	2751	2459	1.1187
2_Way (Reduced)	**`glm.nb`**	22622	**2653**	2232	**1.1882**

Table 5. Deviance and fit statistics for all fitted models.

Figure 2 (next page) is a close-up of the ECDF where the greatest variation is present. It shows how well the four estimated models fit the observed data. It is apparent that the 2-way models fit relatively better for both functions—which appear nearly identical. Figure 3 shows a subset of the observed and expected frequencies for the 2-way models. As expected, the higher observed frequencies are accompanied by estimates with greater variability, as well as being slightly underestimated.

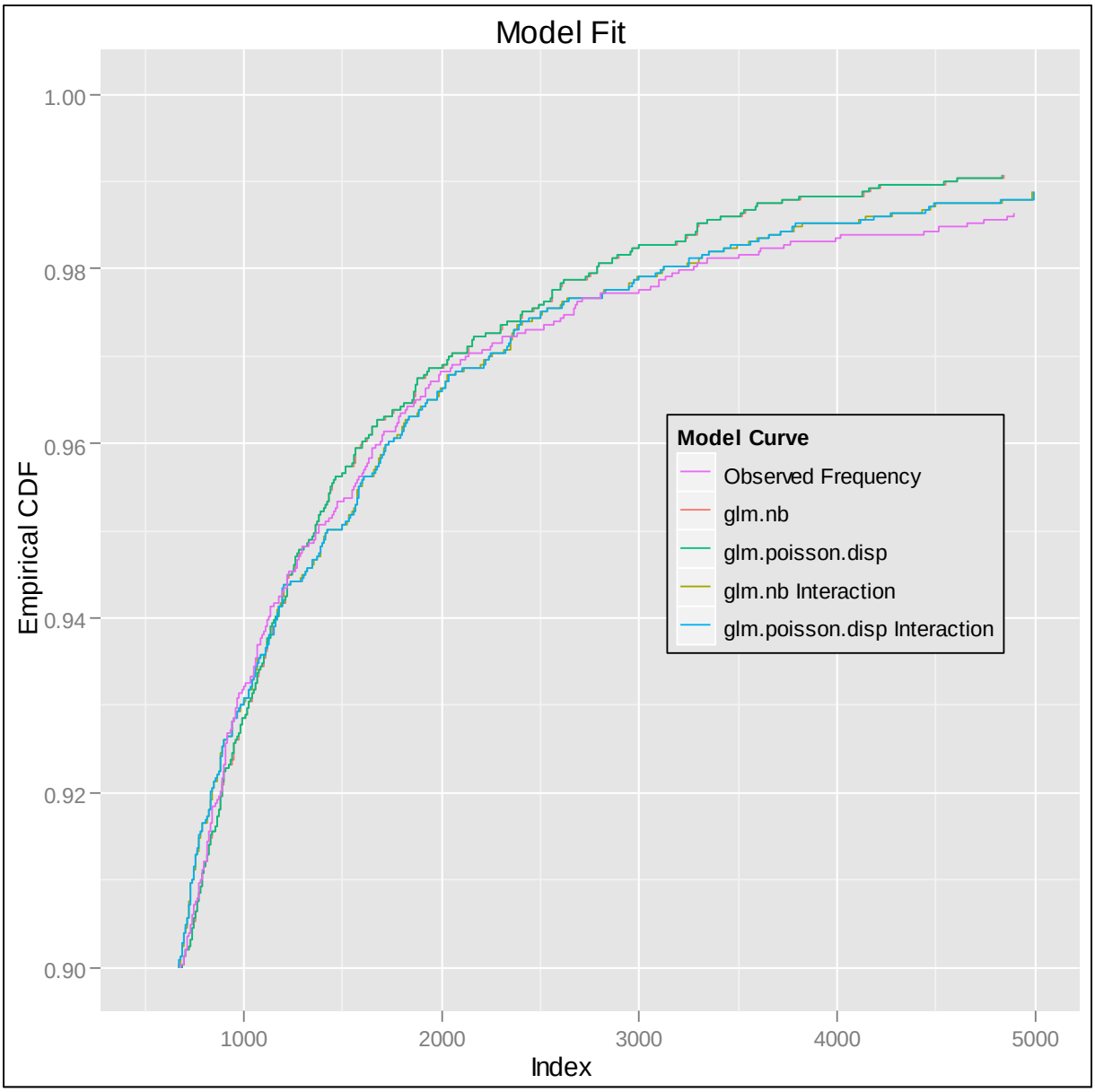

Figure 2. ECDF of all models.

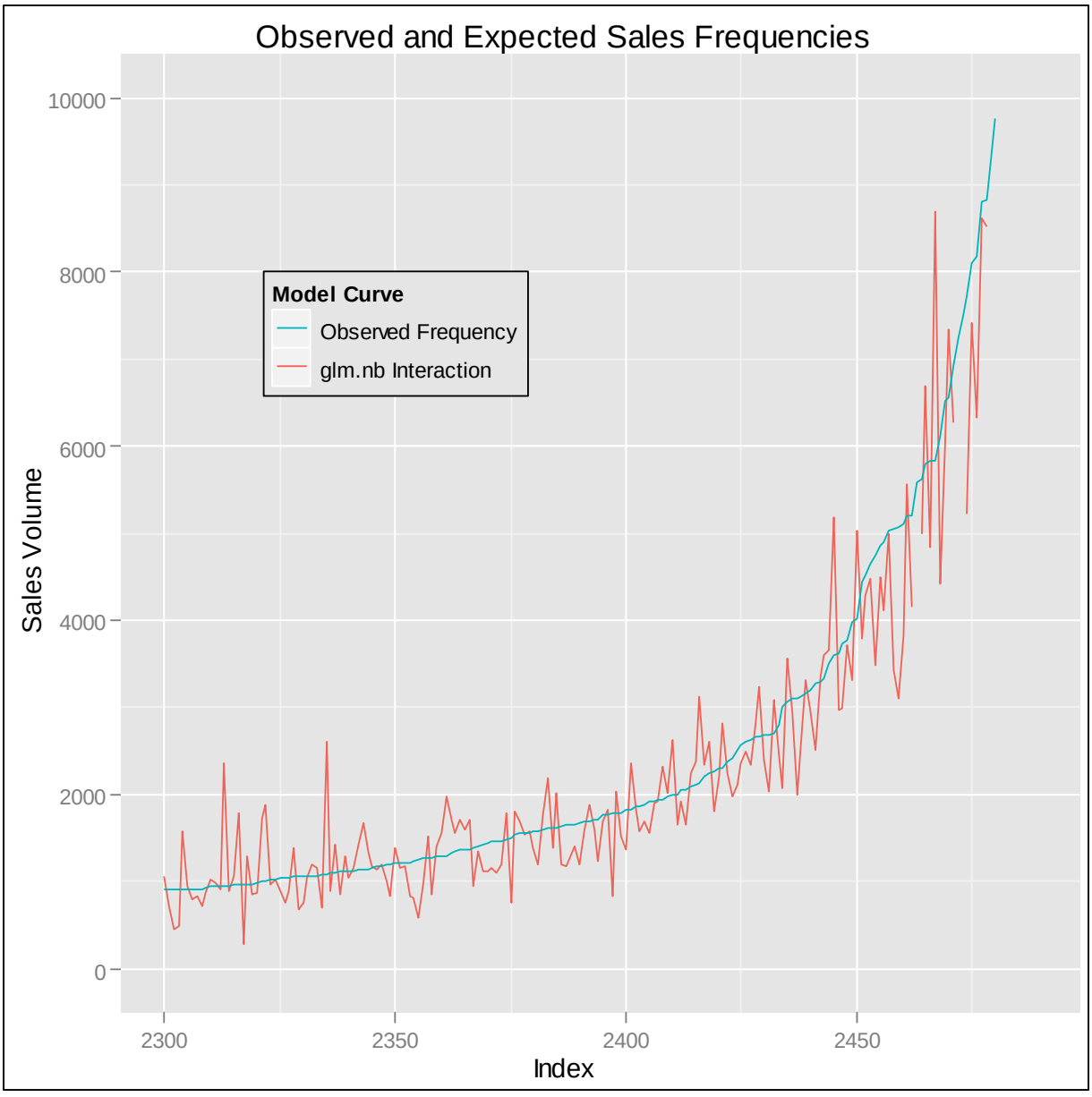

Figure 3. Observed and expected frequencies vs. Sales Volume.

4.3 Model Assumptions

The boxplots of deviance residuals for the covariates show that, for each, no obvious trend is apparent which indicates that the log transform of the baseline count was appropriate (Appendix 1-B.2,3 & 1-C.2,3) (Breslow 1995). Residual vs. Fitted plots given for both functions do not show evidence of non-linearity, or unequal error variances. However, they both show three (different for each function) outliers, but further investigation showed them to have no undue influence on parameter estimates (Appendix 1-B.1 and 1-C.1). Residual vs. Leverage plots did not show any substantial high-leverage points warranting any action, though again, both functions identified different observations as being high-leverage (Appendix 1-B.1 and 1-C.1). Further, DF Beta plots show no issues with highly influential observations (Appendix 1-B.4 and 1-C.4). Also, there is no evidence of over-dispersion, or poor fit seen in the Scale-Location plot for either function and the normal Q-Q plots (Appendix 1-B.1 and 1-C.1) show differing results—that the ML model fits much better than the MM model—but Figure 4 shows that the deviance residuals are approximately normal, again indicating correct model specification and model fit (McCullagh & Nelder 1989, Lawless 1989).

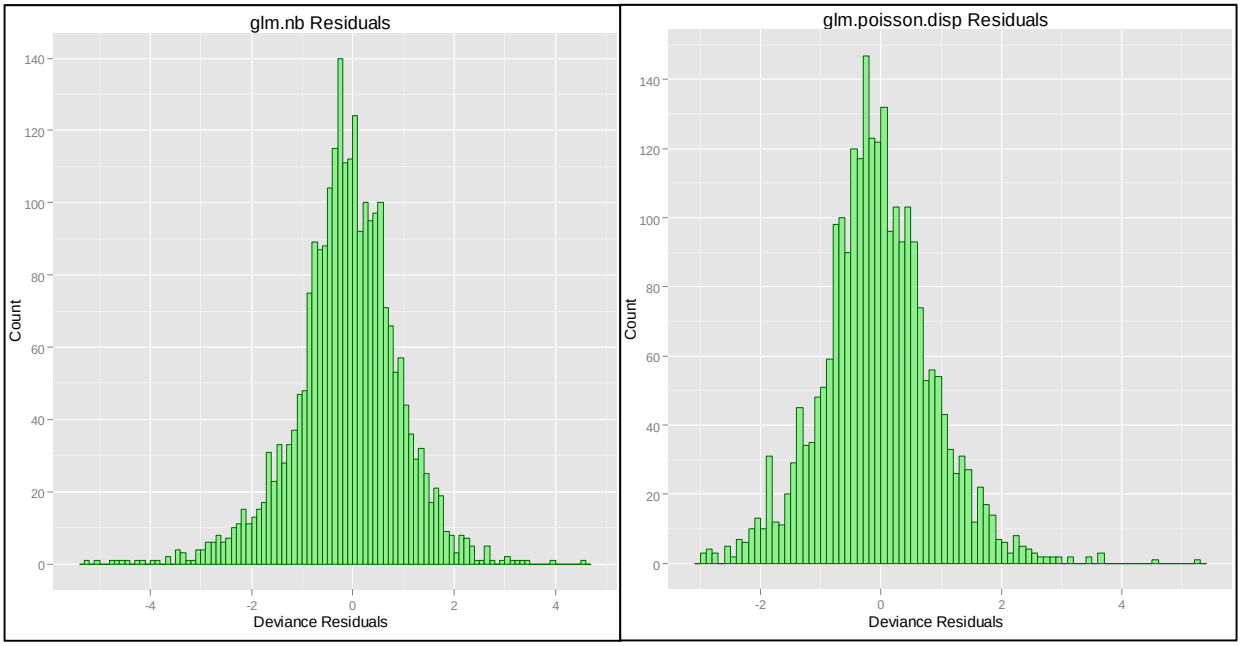

Figure 4. Deviance residuals for both models are approximately normally distributed.

4.4 Differing Model Results

Both models contained parameters that were inestimable because of singularities in the Hessian matrix. The `glm.nb` failed to estimate nine parameters while `glm.poisson.disp` did not estimate eight (Table 6).

`glm.poisson.disp`	`glm.nb`
Bostitch : Not Cordless	Bostitch : Not Cordless
Delta : Not Cordless	Delta : Not Cordless
Festool : Reconditioned	Festool : Reconditioned
Homelite : Not Cordless	Homelite : Not Cordless
Jet : Not Cordless	Jet : Not Cordless
Jet : Reconditioned	Jet : Reconditioned
Powermatic : Not Cordless	Powermatic : Not Cordless
Powermatic : Reconditioned	Powermatic : Reconditioned
-	Skil : Phone

Table 6. Inestimable parameters for both models.

One reason this may happen is because a variable(s) has only two levels. In most instances this is the case, however, the singularities are not arising from the same parameters in both models. Since the models are not estimating the same parameters, the effects of the covariates can be quite different between models, i.e., one model may show a strong positive association, while the other, a strong negative. To work around singularities stemming from this it may be possible to collapse levels, or combine variables at the cost of losing information for other covariate combinations that are available. In addition, the singularity may also arise from a mis-specified model. One aspect of the data that this analysis does not address is the effect of time on the covariates, so it may be that the inclusion of this term may aid in allowing for more estimable parameters.

The direction of many parameters differed between the two functions as well. For instance, of the 226 parameters estimated by both functions, `glm.poisson.disp` estimated 92 negative and 134 positive associations, while `glm.nb` estimated 149 negative and 77 positive associations. Also, 42% of parameter estimates are going in opposite directions with varying degrees of magnitude.

5. Results

As shown previously by Figure 4, the univariate standardized deviance residuals for both models have comparable results that are listed next. Five brands that have the most variability are Ridgid, Dewalt, Bostitch, Skil, and Porter Cable. Similarly brands with the least variability are Jet, Homelite, Makita, and Milwaukee. The variability among *Sex* and *Income* is fairly similar across their respective levels, with males and middle income persons showing slightly more variability in observed frequencies. Variability among sales channels is greatest with *agg_channel*, least with *Branded Web*, and about the same across *Phone*, *Amazon*, and *eBay*. *Cordless* and *New* items exhibited greater variability than *Corded* and *Reconditioned* items, respectively.

Given the large number of comparisons that can be made between all of the variable levels, what is to follow first is an outline of how any comparison between two variables using a conditional odds ratio may be made along with the interpretation of the result. Second, this outline is also done for the odds ratio of any single interaction with respect to the reference level. Third, in the case where one or more of the variables in the interaction has only two levels, the odds ratios is a comparison of that group against the reference group. Also note that the above comparisons should only be done if 1 is not in the 95% confidence interval(s) (95%CI), as these do not indicate any significant difference between variable levels.

Comparison between two variables using a conditional odds ratio

- Divide the odds ratios of any two interactions that have (i) the exact same level of one variable, and (ii) share the type of the other variable.

For instance, using estimates given by `glm.nb`, the association between Black & Decker items being sold on eBay compared to Amazon holding all other variables fixed at the reference level (*male, middle-income, and new, cordless* items) is given by

$$\frac{\text{Black \& } Decker \text{ : Amazon Sales Odds Ratio}}{\text{Black \& } Decker\text{: } eBay \text{ } Sales \text{ } Odds \text{ } Ratio} = \frac{1.439}{.404} = 3.562.$$

This means that any *new* and c*ordless* Black & Decker item purchased by a *middle-income male* is about 3.6 times more likely to be sold on Amazon than it is on eBay. Similarly, the odds of a *new* and c*ordless* Black & Decker item purchased by a *middle-income male* on Amazon are about 256% higher than the odds it is bought on eBay. To use the estimate given by `glm.poisson.disp`, we get a contradicting

direction and magnitude of association—it is now a decrease for Amazon of about 41% compared to eBay.

Interpreting an odds ratio with respect to the reference group

- If the odds ratio of any interaction is below 1, then, with respect to the sales frequency, there is evidence of a negative association between these variable levels when compared to the reference group. If the odds ratio is greater than 1, then there is a positive association.
- Any association for such cases represents the odds of being in the defined group rather than being in the reference group.

This example uses the estimate from `glm.nb`. For instance, given the reference levels of a middle-income male buying a new cordless item, the odds ratio for the interaction between Black & Decker and Phone, 0.55, represents a negative association between these variables and sales volume (frequency) when compared to the sales volume expected from a middle-income male buying a new cordless item from Bosch via the Branded Web site (Bosch and Branded Web are the reference levels for the variables). More simply, this odds ratio is the odds of being in one group rather than another.

This ratio may also be interpreted in the following way: For any middle-income male buying a new cordless Black & Decker item over the phone, there is a decrease in the predicted sales volume by a factor of 0.55, or simply, a 45% decrease when compared to a Bosch item sold via the Branded Web site (for the same any middle-income male buying a new cordless item).

The case were a variable(s) has only two levels

This is a more naturally understood case because the odds ratio represents the odds of being in group rather than the other. This example uses the estimate from `glm.nb`. Consider the interaction between Black & Decker and Reconditioned. For any middle-income male buying a reconditioned cordless Black & Decker item via the branded website, there is a 60% increase in the predicted sales volume when compared to a new item with the other variables held fixed. Another interpretation can be that the odds are 1.6 times higher for a middle-income male buying a reconditioned cordless Black & Decker item via the branded website rather than a new item.

The variables of interest are contained in the interactions listed in Table 2 and are restated here:

Brand : Channel	Channel : Income	Cordless : Condition
Brand : Income	Channel : Sex	Income : Sex
Brand : Sex	Channel : Cordless	Income : Condition
Brand : Cordless	Channel : Condition	Sex : Cordless
Brand : Condition		Sex : Condition

Note again that the interaction between a person's income level and an item being either cordless or not is insignificant. That is, any combination of these two variables does not have an effect on sales volume. Assuming `glm.poisson.disp` is used, Table 7 summarizes interactions having lower than expected sales volumes (interactions where the variables are negatively associated). The interaction between *Brand* and *Channel* is not described because the frequency with which each combination appears is visually and contextually convoluted.

Sex (female and/or unknown) :							
Brand	Bostitch Metabo	Campbell Hausfeld Milwaukee	Delta Panasonic	Dewalt Powermatic	Festool Porter Cable	Homelite Ridgid	Jet Skil
Channel	agg_channel	Phone					
Condition	Reconditioned						
Cordless	Not Cordless						
Income	High						
Not Cordless :							
Brand	Black & Decker Panasonic	Dewalt Porter Cable	Makita Ridgid	Milwaukee			
Channel	agg_channel	eBay					
Condition	Reconditioned						
Sex	Female	Unknown					
Reconditioned:							
Brand	Campbell Hausfeld Metabo	Delta Milwaukee	Dewalt Panasonic	Fein			
Channel	Phone						
Cordless	Not Cordless						
Income	Low						
Sex	Unknown						
Income (low and/or high) :							
Brand	Black & Decker Milwaukee	Campbell Hausfeld Panasonic	Homelite Ridgid	Karcher Ryobi	Fein	Festool	
Channel	agg_channel	Amazon					
Condition	Reconditioned						

Table 7. Interactions showing negative associations

6. Discussion

Though the negative binomial model is more efficient and fully-defined compared to the moment method, allowing for likelihood ratio tests, moment methods are more robust to issues of extra-dispersion (Lawless 1987). Which is *better* may lie in one of the main areas yet to be assessed—an investigation into independence between clusters of data and their correlations. Because temporal and spatial considerations are not addressed through the inclusion of variables like time-of-sale, unique customer identification, or geographical location, it is not clear that all variation is accounted for, or what effect their inclusion may have on the results. Also, if singularities still occur after the inclusion of such covariates, then running models repeatedly with and without each variable may be necessary to determine where they are coming from. However, if these covariates are included, then, for example, prospective analyses, or profile analysis may be utilized.

In addition, further investigation may show that when `glm.poisson.disp` and `glm.nb` estimate the same model their results are indistinguishable from one another. It should also be noted that a *quasi-Poisson* model was estimated, and when the ECFs where compared, it appeared to fit better. Venables and Ripley (2002) suggest the use of *quasi-* models. The only justification for choosing `glm.poisson.disp` over `glm.nb` is that it estimated one additional parameter. However, since `glm.poisson.disp` and `glm.nb` are quite different with respect to parameter estimates, it is recommended that a third function using a *quasi*-likelihood method be tested so that some sort of validation of either the MM or ML model can be made. As mentioned before, the visual fit of the *quasi-* method fit better, so it will likely be the case that this method will be best, given the variables used.

7. Conclusion

Both `glm.nb` and `glm.poisson.disp` identified similar variables to estimate using stepwise selection methods, but showed differences in the inestimable parameters in each model. Estimates of dispersion parameters, and dissimilarity index (DI) values were relatively close to one another; $\hat{\phi}_{NB} = 0.161$ and $\hat{\phi}_{Poi} = 0.188$ (Table 3), and shown by the DI values of 0.38 and 0.35 (Table 4), respectively. As evidenced by the ECDF plot (Figure 2), model fit for the two functions is nearly identical. The notable difference stems from the effect the unstable parameters due to singularities has on the measures of associations: `glm.poisson.disp` estimated 92 negative and 134 positive associations, while `glm.nb` estimated 149 negative and 77 positive associations. That is, 42% of parameter estimates are going in opposite directions with varying degrees of magnitude.

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Appendix 1-A Model Comparisons: Odds Ratios (95% CI)

Table 8. Model comparisons.

1) glm.poisson.disp: 92 covariates have negative association; 134 have positive association. glm.nb: 149 covariates have negative association; 77 have positive association. Associations estimated in different directions are in **bold**.

2) 95% confidence intervals that include 1 are not significant at the $\alpha = 0.05$ level.

3) Between `glm.nb` and `glm.poisson.disp`, 42% (95 of 226) of parameter estimates given by both models are in opposing directions. For `glm.poisson.disp` there were 92 covariates showing negative associations and 134 showing positive associations. For `glm.nb` there were 149 covariates showing negative associations and 77 showing positive associations.

4) Estimates are rounded to the 2nd and 3rd decimal where appropriate to show that a 0 is not returned.

5) Parameters estimated by both models.

Parameters	glm.poisson.disp coef (se)	glm.nb coef (se)	glm.poisson.disp Odds Ratio (95% CI)	glm.nb Odds Ratio (95% CI)
(Intercept)	7.07 (0.11)	4.43 (0.11)		
agg_channel : Female	-0.55 (0.08)	-0.56 (0.08)	0.58 (0.46, 0.71)	0.573 (0.491, 0.67)
agg_channel : High Income	-0.06 (0.06)	-0.05 (0.06)	0.95 (0.81, 1.11)	0.948 (0.846, 1.06)
agg_channel : Low Income	0.09 (0.06)	0.09 (0.05)	1.1 (0.95, 1.27)	1.096 (0.987, 1.22)
agg_channel : Not Cordless	-0.62 (0.08)	-0.62 (0.07)	0.54 (0.44, 0.66)	0.54 (0.468, 0.62)
agg_channel : Reconditioned	1.41 (0.07)	1.41 (0.07)	4.1 (3.41, 4.93)	4.099 (3.593, 4.68)
agg_channel : Sex Not Known	0.02 (0.08)	0.02 (0.08)	1.03 (0.83, 1.26)	1.022 (0.881, 1.19)
Amazon Sales : Female	0.56 (0.07)	0.56 (0.06)	1.75 (1.47, 2.10)	1.754 (1.545, 1.99)
Amazon Sales : High Income	-0.19 (0.05)	-0.19 (0.05)	0.82 (0.72, 0.94)	0.823 (0.75, 0.9)
Amazon Sales : Low Income	-0.02 (0.05)	-0.02 (0.05)	0.98 (0.87, 1.12)	0.983 (0.898, 1.08)
Amazon Sales : Not Cordless	-0.07 (0.07)	-0.06 (0.06)	0.94 (0.79, 1.11)	0.941 (0.834, 1.06)
Amazon Sales : Reconditioned	0.94 (0.06)	0.95 (0.06)	2.56 (2.19, 2.99)	2.575 (2.304, 2.88)
Amazon Sales : Sex Not Known	0.51 (0.07)	0.51 (0.07)	1.67 (1.39, 1.99)	1.664 (1.465, 1.89)
Black & Decker : agg_channel	**0.65 (0.17)**	**-1.49 (0.18)**	**1.92 (1.24, 2.97)**	**0.226 (0.16, 0.32)**
Black & Decker : Amazon Sales	1.31 (0.15)	0.36 (0.15)	3.7 (2.53, 5.41)	1.439 (1.074, 1.93)
Black & Decker : eBay Sales	**1.84 (0.15)**	**-0.91 (0.15)**	**6.31 (4.24, 9.37)**	**0.404 (0.299, 0.55)**
Black & Decker : Female	**0.99 (0.12)**	**-0.73 (0.1)**	**2.69 (1.97, 3.68)**	**0.484 (0.4, 0.59)**
Black & Decker : High Income	**-0.09 (0.09)**	**0.65 (0.07)**	**0.91 (0.73, 1.15)**	**1.912 (1.657, 2.21)**
Black & Decker : Low Income	**0.05 (0.09)**	**-1.62 (0.07)**	**1.06 (0.85, 1.32)**	**0.198 (0.173, 0.23)**
Black & Decker : Not Cordless	**-1.38 (0.1)**	**0.67 (0.09)**	**0.25 (0.19, 0.32)**	**1.945 (1.642, 2.3)**
Black & Decker : Phone	-0.6 (0.15)	-0.8 (0.14)	0.55 (0.37, 0.82)	0.45 (0.341, 0.59)
Black & Decker : Reconditioned	0.34 (0.1)	0.47 (0.08)	1.4 (1.08, 1.82)	1.602 (1.357, 1.89)
Black & Decker : Sex Not Known	**0.2 (0.12)**	**-1.76 (0.1)**	**1.22 (0.89, 1.67)**	**0.173 (0.142, 0.21)**
Bostitch : agg_channel	**0.43 (0.2)**	**-0.19 (0.2)**	**1.54 (0.92, 2.57)**	**0.825 (0.562, 1.21)**
Bostitch : Amazon Sales	0.18 (0.18)	0.75 (0.18)	1.19 (0.74, 1.91)	2.125 (1.495, 3.02)
Bostitch : eBay Sales	**0.54 (0.19)**	**-0.69 (0.19)**	**1.71 (1.04, 2.81)**	**0.5 (0.346, 0.72)**
Bostitch : Female	**0.24 (0.15)**	**-1.48 (0.13)**	**1.26 (0.86, 1.86)**	**0.227 (0.175, 0.29)**
Bostitch : High Income	0.13 (0.11)	0.87 (0.09)	1.14 (0.86, 1.50)	2.386 (1.993, 2.86)
Bostitch : Low Income	**0.08 (0.1)**	**-1.59 (0.09)**	**1.08 (0.83, 1.41)**	**0.204 (0.172, 0.24)**

Table 7 Model comparisons (cont.)	glm.poisson.disp	glm.nb	glm.poisson.disp	glm.nb
Parameters	coef (se)	coef (se)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Bostitch : Phone	**-0.1 (0.19)**	**1.22 (0.17)**	**0.91 (0.56, 1.46)**	**3.374 (2.432, 4.68)**
Bostitch : Reconditioned	0.93 (0.12)	1.07 (0.11)	2.55 (1.85, 3.50)	2.915 (2.343, 3.63)
Bostitch : Sex Not Known	-0.01 (0.15)	-1.96 (0.13)	0.99 (0.68, 1.46)	0.141 (0.109, 0.18)
Campbell Hausfeld : agg_channel	**0.12 (0.19)**	**-3.84 (0.21)**	**1.12 (0.68, 1.85)**	**0.022 (0.014, 0.03)**
Campbell Hausfeld : Amazon Sales	**0.13 (0.16)**	**-2.62 (0.17)**	**1.14 (0.75, 1.74)**	**0.073 (0.052, 0.1)**
Campbell Hausfeld : eBay Sales	**0.8 (0.17)**	**-3.75 (0.19)**	**2.23 (1.43, 3.48)**	**0.024 (0.016, 0.03)**
Campbell Hausfeld : Female	**0.39 (0.13)**	**-1.33 (0.11)**	**1.48 (1.05, 2.09)**	**0.266 (0.212, 0.33)**
Campbell Hausfeld : High Income	**-0.02 (0.1)**	**0.72 (0.08)**	**0.98 (0.76, 1.27)**	**2.06 (1.749, 2.43)**
Campbell Hausfeld : Low Income	**0.15 (0.1)**	**-1.52 (0.08)**	**1.16 (0.91, 1.49)**	**0.218 (0.187, 0.25)**
Campbell Hausfeld : Not Cordless	1.57 (0.13)	3.62 (0.11)	4.78 (3.44, 6.66)	37.195 (29.984, 46.14)
Campbell Hausfeld : Phone	-0.37 (0.16)	-2.38 (0.16)	0.69 (0.45, 1.06)	0.092 (0.067, 0.13)
Campbell Hausfeld : Reconditioned	-0.3 (0.11)	-0.16 (0.1)	0.74 (0.56, 0.99)	0.856 (0.708, 1.04)
Campbell Hausfeld : Sex Not Known	**0 (0.14)**	**-1.96 (0.12)**	**1 (0.70, 1.42)**	**0.141 (0.112, 0.18)**
Delta : agg_channel	-0.53 (0.24)	-0.61 (0.22)	0.59 (0.32, 1.10)	0.543 (0.351, 0.84)
Delta : Amazon Sales	**-0.14 (0.19)**	**0.99 (0.19)**	**0.87 (0.53, 1.42)**	**2.7 (1.863, 3.91)**
Delta : eBay Sales	-1.98 (0.31)	-2.69 (0.29)	0.14 (0.06, 0.31)	0.068 (0.038, 0.12)
Delta : Female	-0.18 (0.17)	-1.91 (0.15)	0.83 (0.53, 1.30)	0.149 (0.11, 0.2)
Delta : High Income	0.08 (0.13)	0.83 (0.11)	1.08 (0.78, 1.50)	2.282 (1.841, 2.83)
Delta : Low Income	**0.14 (0.12)**	**-1.54 (0.1)**	**1.15 (0.84, 1.56)**	**0.215 (0.175, 0.26)**
Delta : Phone	0.32 (0.19)	2.19 (0.18)	1.38 (0.83, 2.27)	8.919 (6.31, 12.61)
Delta : Reconditioned	-2.03 (0.14)	-1.89 (0.13)	0.13 (0.09, 0.19)	0.151 (0.117, 0.2)
Delta : Sex Not Known	-0.21 (0.17)	-2.17 (0.15)	0.81 (0.52, 1.26)	0.114 (0.085, 0.15)
Dewalt : agg_channel	**0.78 (0.16)**	**-0.28 (0.15)**	**2.18 (1.45, 3.27)**	**0.752 (0.555, 1.02)**
Dewalt : Amazon Sales	-0.43 (0.15)	-0.29 (0.15)	0.65 (0.44, 0.96)	0.751 (0.558, 1.01)
Dewalt : eBay Sales	**0.31 (0.16)**	**-1.36 (0.16)**	**1.37 (0.90, 2.08)**	**0.258 (0.188, 0.35)**
Dewalt : Female	**0.13 (0.12)**	**-1.59 (0.1)**	**1.14 (0.83, 1.56)**	**0.205 (0.169, 0.25)**
Dewalt : High Income	0.28 (0.09)	1.02 (0.07)	1.33 (1.05, 1.680	2.777 (2.402, 3.21)
Dewalt : Low Income	**0.08 (0.09)**	**-1.6 (0.07)**	**1.08 (0.87, 1.34)**	**0.203 (0.177, 0.23)**
Dewalt : Not Cordless	**-1.01 (0.1)**	**1.04 (0.09)**	**0.37 (0.28, 0.47)**	**2.833 (2.396, 3.35)**
Dewalt : Phone	**-0.53 (0.15)**	**0.35 (0.14)**	**0.59 (0.40, 0.87)**	**1.42 (1.08, 1.87)**
Dewalt : Reconditioned	-0.63 (0.1)	-0.49 (0.08)	0.53 (0.41, 0.69)	0.615 (0.522, 0.73)
Dewalt : Sex Not Known	-0.09 (0.12)	-2.04 (0.1)	0.92 (0.67, 1.25)	0.13 (0.107, 0.16)
eBay Sales : Female	0.2 (0.08)	0.19 (0.07)	1.22 (1.00, 1.48)	1.214 (1.058, 1.39)
eBay Sales : High Income	0.39 (0.06)	0.4 (0.05)	1.48 (1.28, 1.72)	1.486 (1.338, 1.65)
eBay Sales : Low Income	0.13 (0.05)	0.13 (0.05)	1.14 (1.00, 1.31)	1.138 (1.034, 1.25)
eBay Sales : Not Cordless	-0.03 (0.07)	-0.02 (0.07)	0.97 (0.81, 1.17)	0.978 (0.858, 1.12)
eBay Sales : Reconditioned	1.54 (0.07)	1.55 (0.06)	4.68 (3.95, 5.55)	4.702 (4.166, 5.31)
eBay Sales : Sex Not Known	0.44 (0.08)	0.43 (0.07)	1.55 (1.28, 1.88)	1.544 (1.345, 1.77)
Fein : agg_channel	-0.18 (0.25)	-5.98 (0.32)	0.84 (0.43, 1.60)	0.003 (0.001, 0)
Fein : Amazon Sales	**0.29 (0.22)**	**-4.29 (0.28)**	**1.33 (0.76, 2.34)**	**0.014 (0.008, 0.02)**
Fein : eBay Sales	**1.46 (0.2)**	**-4.92 (0.28)**	**4.31 (2.57, 7.26)**	**0.007 (0.004, 0.01)**

Table 7 Model comparisons (cont.)	glm.poisson.disp	glm.nb	glm.poisson.disp	glm.nb
Parameters	coef (se)	coef (se)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Fein : Female	**0.37 (0.17)**	**-1.35 (0.15)**	**1.45 (0.94, 2.23)**	**0.258 (0.193, 0.35)**
Fein : High Income	**-0.15 (0.13)**	**0.6 (0.11)**	**0.86 (0.62, 1.19)**	**1.816 (1.468, 2.25)**
Fein : Low Income	-0.03 (0.12)	-1.7 (0.1)	0.97 (0.71, 1.32)	0.182 (0.148, 0.22)
Fein : Not Cordless	2.64 (0.24)	4.72 (0.23)	14.02 (7.47, 26.31)	112.561 (72.367, 175.08)
Fein : Phone	-0.31 (0.2)	-4.16 (0.26)	0.73 (0.44, 1.22)	0.016 (0.009, 0.03)
Fein : Reconditioned	-1.97 (0.16)	-1.84 (0.14)	0.14 (0.09, 0.21)	0.159 (0.12, 0.21)
Fein : Sex Not Known	**0.01 (0.17)**	**-1.96 (0.15)**	**1.01 (0.65, 1.56)**	**0.141 (0.105, 0.19)**
Female : Not Cordless	-0.15 (0.05)	-0.15 (0.05)	0.86 (0.75, 0.99)	0.862 (0.779, 0.95)
Female : Reconditioned	-0.49 (0.05)	-0.49 (0.05)	0.61 (0.54, 0.70)	0.613 (0.558, 0.67)
Festool : agg_channel	-0.13 (0.33)	-4.86 (0.35)	0.88 (0.37, 2.08)	0.008 (0.004, 0.02)
Festool : Amazon Sales	-0.26 (0.22)	-3.8 (0.25)	0.77 (0.44, 1.37)	0.022 (0.014, 0.04)
Festool : eBay Sales	-1.39 (0.36)	-6.74 (0.37)	0.25 (0.10, 0.62)	0.001 (0.001, 0)
Festool : Female	-0.31 (0.21)	-2.03 (0.18)	0.73 (0.43, 1.25)	0.131 (0.092, 0.19)
Festool : High Income	**-0.32 (0.15)**	**0.43 (0.13)**	**0.73 (0.50, 1.07)**	**1.538 (1.191, 1.99)**
Festool : Low Income	-0.04 (0.15)	-1.71 (0.13)	0.96 (0.65, 1.43)	0.181 (0.139, 0.24)
Festool : Not Cordless	1.81 (0.21)	3.89 (0.19)	6.14 (3.57, 10.55)	48.797 (33.618, 70.83)
Festool : Phone	**0.05 (0.22)**	**-2.75 (0.24)**	**1.05 (0.59, 1.87)**	**0.064 (0.04, 0.1)**
Festool : Sex Not Known	**0.1 (0.2)**	**-1.86 (0.18)**	**1.11 (0.66, 1.86)**	**0.155 (0.11, 0.22)**
High Income : Female	0.21 (0.04)	0.21 (0.04)	1.23 (1.10, 1.38)	1.231 (1.136, 1.33)
High Income : Reconditioned	0.12 (0.04)	0.12 (0.04)	1.13 (1.02, 1.24)	1.129 (1.053, 1.21)
High Income : Sex Not Known	-0.04 (0.04)	-0.04 (0.04)	0.96 (0.86, 1.07)	0.96 (0.887, 1.04)
Homelite : agg_channel	**1.23 (0.25)**	**-5.8 (0.51)**	**3.43 (1.82, 6.47)**	**0.003 (0.001, 0.01)**
Homelite : Amazon Sales	**0.36 (0.24)**	**-5.47 (0.51)**	**1.43 (0.77, 2.63)**	**0.004 (0.002, 0.01)**
Homelite : eBay Sales	**1.99 (0.24)**	**-5.64 (0.51)**	**7.32 (3.95, 13.59)**	**0.004 (0.001, 0.01)**
Homelite : Female	**0.33 (0.19)**	**-1.38 (0.17)**	**1.39 (0.86, 2.26)**	**0.251 (0.179, 0.35)**
Homelite : High Income	0.03 (0.13)	0.77 (0.12)	1.03 (0.73, 1.46)	2.165 (1.706, 2.75)
Homelite : Low Income	**0.13 (0.13)**	**-1.55 (0.12)**	**1.14 (0.81, 1.59)**	**0.213 (0.169, 0.27)**
Homelite : Phone	-0.41 (0.25)	-5.5 (0.5)	0.66 (0.35, 1.25)	0.004 (0.002, 0.01)
Homelite : Reconditioned	6.7 (0.5)	6.84 (0.47)	810.22 (225.89, 2906.08)	933.375 (369.889, 2355.27)
Homelite : Sex Not Known	-0.05 (0.19)	-2.01 (0.17)	0.95 (0.59, 1.54)	0.134 (0.096, 0.19)
Jet : agg_channel	-0.6 (0.33)	-1.22 (0.28)	0.55 (0.24, 1.27)	0.295 (0.17, 0.51)
Jet : Amazon Sales	0.78 (0.24)	1.37 (0.21)	2.17 (1.17, 4.03)	3.951 (2.617, 5.96)
Jet : eBay Sales	1.78 (0.25)	0.57 (0.22)	5.94 (3.14, 11.25)	1.776 (1.162, 2.72)
Jet : Female	-0.37 (0.2)	-2.09 (0.18)	0.69 (0.41, 1.16)	0.123 (0.087, 0.18)
Jet : High Income	0.27 (0.15)	1.01 (0.13)	1.31 (0.90, 1.91)	2.742 (2.135, 3.52)
Jet : Low Income	**0.1 (0.14)**	**-1.57 (0.12)**	**1.1 (0.77, 1.58)**	**0.207 (0.163, 0.26)**
Jet : Phone	0.42 (0.24)	1.75 (0.2)	1.52 (0.82, 2.82)	5.775 (3.887, 8.58)
Jet : Sex Not Known	-0.14 (0.2)	-2.09 (0.18)	0.87 (0.52, 1.45)	0.123 (0.087, 0.17)
Karcher : agg_channel	**0.83 (0.2)**	**-4.75 (0.36)**	**2.3 (1.38, 3.82)**	**0.009 (0.004, 0.02)**
Karcher : Amazon Sales	**0.56 (0.18)**	**-3.82 (0.35)**	**1.75 (1.09, 2.81)**	**0.022 (0.011, 0.04)**
Karcher : eBay Sales	**1.02 (0.19)**	**-5.17 (0.37)**	**2.76 (1.69, 4.51)**	**0.006 (0.003, 0.01)**

Table 7 Model comparisons (cont.)	glm.poisson.disp	glm.nb	glm.poisson.disp	glm.nb
Parameters	coef (se)	coef (se)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Karcher : Female	**0.46 (0.15)**	**-1.27 (0.13)**	**1.58 (1.08, 2.30)**	**0.282 (0.219, 0.36)**
Karcher : High Income	**-0.37 (0.11)**	**0.37 (0.09)**	**0.69 (0.53, 0.91)**	**1.453 (1.217, 1.73)**
Karcher : Low Income	-0.11 (0.1)	-1.78 (0.09)	0.9 (0.69, 1.17)	0.168 (0.141, 0.2)
Karcher : Not Cordless	2.74 (0.36)	4.82 (0.34)	15.45 (6.17, 38.72)	124.025 (63.16, 243.54)
Karcher : Phone	-0.36 (0.19)	-4 (0.37)	0.7 (0.43, 1.13)	0.018 (0.009, 0.04)
Karcher : Reconditioned	0.43 (0.12)	0.57 (0.11)	1.54 (1.12, 2.12)	1.775 (1.427, 2.21)
Karcher : Sex Not Known	**0.06 (0.15)**	**-1.9 (0.13)**	**1.06 (0.72, 1.56)**	**0.149 (0.115, 0.19)**
Low Income : Female	0.17 (0.04)	0.17 (0.04)	1.19 (1.07, 1.32)	1.184 (1.099, 1.28)
Low Income : Reconditioned	-0.02 (0.04)	-0.02 (0.03)	0.98 (0.90, 1.08)	0.985 (0.922, 1.05)
Low Income : Sex Not Known	0.08 (0.04)	0.07 (0.04)	1.08 (0.97, 1.20)	1.077 (0.999, 1.16)
Makita : agg_channel	-0.83 (0.17)	-2.01 (0.17)	0.44 (0.28, 0.67)	0.134 (0.097, 0.19)
Makita : Amazon Sales	-0.37 (0.15)	-0.35 (0.15)	0.69 (0.47, 1.01)	0.706 (0.526, 0.95)
Makita : eBay Sales	**0.34 (0.16)**	**-1.45 (0.16)**	**1.4 (0.94, 2.09)**	**0.234 (0.172, 0.32)**
Makita : Female	**0.16 (0.12)**	**-1.55 (0.1)**	**1.18 (0.86, 1.61)**	**0.212 (0.175, 0.26)**
Makita : High Income	0.08 (0.09)	0.82 (0.07)	1.08 (0.86, 1.36)	2.274 (1.974, 2.62)
Makita : Low Income	**0.07 (0.09)**	**-1.61 (0.07)**	**1.07 (0.86, 1.33)**	**0.201 (0.175, 0.23)**
Makita : Not Cordless	**-0.53 (0.1)**	**1.52 (0.08)**	**0.59 (0.46, 0.76)**	**4.586 (3.883, 5.42)**
Makita : Phone	**-0.06 (0.15)**	**0.7 (0.14)**	**0.94 (0.64, 1.38)**	**2.011 (1.536, 2.63)**
Makita : Reconditioned	0.21 (0.1)	0.35 (0.08)	1.24 (0.96, 1.60)	1.425 (1.211, 1.68)
Makita : Sex Not Known	**0.09 (0.12)**	**-1.86 (0.1)**	**1.1 (0.81, 1.50)**	**0.156 (0.129, 0.19)**
Metabo : agg_channel	-0.29 (0.28)	-5.37 (0.31)	0.75 (0.36, 1.53)	0.005 (0.003, 0.01)
Metabo : Amazon Sales	-0.12 (0.2)	-3.99 (0.24)	0.89 (0.53, 1.49)	0.019 (0.012, 0.03)
Metabo : eBay Sales	**0.91 (0.22)**	**-4.77 (0.26)**	**2.49 (1.43, 4.34)**	**0.008 (0.005, 0.01)**
Metabo : Female	-0.03 (0.17)	-1.75 (0.15)	0.97 (0.62, 1.52)	0.173 (0.128, 0.23)
Metabo : High Income	0.09 (0.13)	0.84 (0.11)	1.09 (0.78, 1.52)	2.316 (1.861, 2.88)
Metabo : Low Income	**0.27 (0.12)**	**-1.4 (0.1)**	**1.31 (0.96, 1.80)**	**0.246 (0.201, 0.3)**
Metabo : Not Cordless	1.73 (0.2)	3.79 (0.18)	5.62 (3.33, 9.49)	44.398 (30.925, 63.74)
Metabo : Phone	**0.44 (0.19)**	**-2.7 (0.22)**	**1.55 (0.95, 2.53)**	**0.068 (0.044, 0.1)**
Metabo : Reconditioned	-2.02 (0.15)	-1.88 (0.14)	0.13 (0.09, 0.20)	0.153 (0.116, 0.2)
Metabo : Sex Not Known	**0.18 (0.17)**	**-1.78 (0.15)**	**1.19 (0.78, 1.83**	**0.168 (0.126, 0.22)**
Milwaukee : agg_channel	-0.39 (0.16)	-0.75 (0.16)	0.68 (0.45, 1.02)	0.473 (0.347, 0.64)
Milwaukee : Amazon Sales	0.01 (0.15)	0.86 (0.15)	1.01 (0.69, 1.48)	2.372 (1.774, 3.17)
Milwaukee : eBay Sales	**0.8 (0.15)**	**-0.15 (0.15)**	**2.23 (1.51, 3.32)**	**0.862 (0.64, 1.16)**
Milwaukee : Female	-0.07 (0.12)	-1.78 (0.1)	0.93 (0.69, 1.27)	0.168 (0.139, 0.2)
Milwaukee : High Income	0.26 (0.09)	1 (0.07)	1.3 (1.04, 1.62)	2.719 (2.367, 3.12)
Milwaukee : Low Income	**0.05 (0.08)**	**-1.62 (0.07)**	**1.05 (0.85, 1.30)**	**0.197 (0.173, 0.23)**
Milwaukee : Not Cordless	**-1.23 (0.1)**	**0.82 (0.08)**	**0.29 (0.23, 0.38)**	**2.263 (1.921, 2.67)**
Milwaukee : Phone	**-0.18 (0.15)**	**1.41 (0.14)**	**0.83 (0.57, 1.22)**	**4.087 (3.129, 5.34)**
Milwaukee : Reconditioned	-0.21 (0.1)	-0.07 (0.08)	0.81 (0.63, 1.04)	0.931 (0.794, 1.09)
Milwaukee : Sex Not Known	-0.18 (0.12)	-2.13 (0.1)	0.84 (0.62, 1.14)	0.119 (0.099, 0.14)
Not Cordless : Reconditioned	-0.47 (0.05)	-0.47 (0.05)	0.63 (0.55, 0.71)	0.623 (0.57, 0.68)

Table 7 Model comparisons (cont.)	glm.poisson.disp	glm.nb	glm.poisson.disp	glm.nb
Parameters	coef (se)	coef (se)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Panasonic : agg_channel	**0.56 (0.26)**	**-3.11 (0.25)**	**1.76 (0.89, 3.46)**	**0.045 (0.027, 0.07)**
Panasonic : Amazon Sales	**1.08 (0.18)**	**-1.36 (0.18)**	**2.95 (1.86, 4.68)**	**0.256 (0.181, 0.36)**
Panasonic : eBay Sales	**1.25 (0.22)**	**-3.01 (0.21)**	**3.48 (1.96, 6.21)**	**0.049 (0.032, 0.07)**
Panasonic : Female	-0.06 (0.17)	-1.78 (0.15)	0.95 (0.60, 1.48)	0.169 (0.125, 0.23)
Panasonic : High Income	**-0.02 (0.13)**	**0.72 (0.12)**	**0.98 (0.69, 1.38)**	**2.059 (1.635, 2.59)**
Panasonic : Low Income	**0.14 (0.12)**	**-1.54 (0.11)**	**1.15 (0.83, 1.58)**	**0.214 (0.173, 0.27)**
Panasonic : Not Cordless	-2.35 (0.14)	-0.31 (0.12)	0.1 (0.07, 0.14)	0.734 (0.58, 0.93)
Panasonic : Phone	**0.03 (0.2)**	**-1.69 (0.18)**	**1.03 (0.61, 1.74)**	**0.185 (0.13, 0.26)**
Panasonic : Reconditioned	-1.31 (0.14)	-1.17 (0.12)	0.27 (0.19, 0.39)	0.309 (0.244, 0.39)
Panasonic : Sex Not Known	**0.27 (0.17)**	**-1.7 (0.14)**	**1.31 (0.85, 2.01)**	**0.184 (0.138, 0.24)**
Phone : Female	-0.04 (0.07)	-0.04 (0.07)	0.96 (0.80, 1.16)	0.962 (0.845, 1.1)
Phone : High Income	0.15 (0.05)	0.15 (0.05)	1.16 (1.01, 1.33)	1.157 (1.051, 1.28)
Phone : Low Income	0.11 (0.05)	0.11 (0.05)	1.11 (0.98, 1.27)	1.112 (1.014, 1.22)
Phone : Not Cordless	0 (0.07)	0.01 (0.06)	1 (0.84, 1.19)	1.007 (0.89, 1.14)
Phone : Reconditioned	-0.18 (0.06)	-0.18 (0.06)	0.83 (0.71, 0.98)	0.832 (0.743, 0.93)
Phone : Sex Not Known	-0.05 (0.07)	-0.06 (0.07)	0.95 (0.79, 1.14)	0.946 (0.829, 1.08)
Porter Cable : agg_channel	**0.2 (0.16)**	**-1.3 (0.17)**	**1.22 (0.80, 1.86)**	**0.271 (0.196, 0.38)**
Porter Cable : Amazon Sales	-0.65 (0.15)	-0.96 (0.15)	0.52 (0.35, 0.77)	0.384 (0.284, 0.52)
Porter Cable : eBay Sales	-0.37 (0.17)	-2.49 (0.18)	0.69 (0.45, 1.08)	0.083 (0.059, 0.12)
Porter Cable : Female	**0.13 (0.12)**	**-1.59 (0.1)**	**1.13 (0.82, 1.56)**	**0.203 (0.167, 0.25)**
Porter Cable : High Income	0.12 (0.09)	0.86 (0.07)	1.12 (0.89, 1.42)	2.352 (2.032, 2.72)
Porter Cable : Low Income	**0.11 (0.09)**	**-1.56 (0.07)**	**1.12 (0.89, 1.40)**	**0.21 (0.183, 0.24)**
Porter Cable : Not Cordless	**-0.13 (0.1)**	**1.93 (0.09)**	**0.88 (0.67, 1.15)**	**6.865 (5.78, 8.15)**
Porter Cable : Phone	**-0.08 (0.15)**	**0.35 (0.14)**	**0.92 (0.62, 1.35)**	**1.425 (1.084, 1.87)**
Porter Cable : Reconditioned	0.01 (0.1)	0.15 (0.09)	1.01 (0.78, 1.32)	1.163 (0.982, 1.38)
Porter Cable : Sex Not Known	-0.22 (0.12)	-2.18 (0.1)	0.8 (0.58, 1.10)	0.113 (0.093, 0.14)
Powermatic : agg_channel	**0.23 (0.42)**	**-2.35 (0.36)**	**1.26 (0.43, 3.67)**	**0.096 (0.047, 0.19)**
Powermatic : Amazon Sales	1.79 (0.26)	0.41 (0.22)	6.01 (3.08, 11.75)	1.512 (0.976, 2.34)
Powermatic : eBay Sales	**1.1 (0.33)**	**-2.1 (0.29)**	**2.99 (1.27, 7.04)**	**0.123 (0.07, 0.22)**
Powermatic : Female	-0.82 (0.24)	-2.54 (0.22)	0.44 (0.24, 0.82)	0.079 (0.051, 0.12)
Powermatic : High Income	0.14 (0.18)	0.86 (0.16)	1.15 (0.73, 1.80)	2.375 (1.741, 3.24)
Powermatic : Low Income	-0.16 (0.16)	-1.83 (0.15)	0.85 (0.56, 1.30)	0.16 (0.12, 0.21)
Powermatic : Phone	1.19 (0.26)	0.55 (0.22)	3.28 (1.66, 6.48)	1.733 (1.134, 2.65)
Powermatic : Sex Not Known	-0.44 (0.23)	-2.39 (0.21)	0.65 (0.35, 1.18)	0.091 (0.06, 0.14)
Ridgid : agg_channel	**0.93 (0.17)**	**-1.76 (0.17)**	**2.53 (1.63, 3.93)**	**0.172 (0.123, 0.24)**
Ridgid : Amazon Sales	**0.23 (0.16)**	**-1.25 (0.16)**	**1.26 (0.84, 1.900**	**0.288 (0.21, 0.39)**
Ridgid : eBay Sales	**1.53 (0.17)**	**-1.75 (0.18)**	**4.63 (3.00, 7.15)**	**0.173 (0.122, 0.25)**
Ridgid : Female	-0.01 (0.13)	-1.73 (0.11)	0.99 (0.71, 1.39)	0.178 (0.144, 0.22)
Ridgid : High Income	0.13 (0.1)	0.87 (0.08)	1.14 (0.88, 1.47)	2.388 (2.028, 2.81)
Ridgid : Low Income	**0.06 (0.09)**	**-1.61 (0.08)**	**1.06 (0.84, 1.35)**	**0.2 (0.172, 0.23)**
Ridgid : Not Cordless	**-1.16 (0.11)**	**0.9 (0.1)**	**0.31 (0.24, 0.42)**	**2.456 (2.031, 2.97)**

Table 7 Model comparisons (cont.)	glm.poisson.disp	glm.nb	glm.poisson.disp	glm.nb
Parameters	coef (se)	coef (se)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Ridgid : Phone	-0.43 (0.17)	-1.17 (0.16)	0.65 (0.42, 1.00)	0.31 (0.226, 0.42)
Ridgid : Reconditioned	0.63 (0.11)	0.77 (0.1)	1.88 (1.41, 2.51)	2.169 (1.796, 2.62)
Ridgid : Sex Not Known	-0.16 (0.13)	-2.11 (0.11)	0.86 (0.61, 1.20)	0.121 (0.098, 0.15)
Ryobi : agg_channel	**0.52 (0.18)**	**-3.89 (0.21)**	**1.68 (1.06, 2.65)**	**0.02 (0.014, 0.03)**
Ryobi : Amazon Sales	**0.67 (0.16)**	**-2.55 (0.19)**	**1.95 (1.28, 2.95)**	**0.078 (0.054, 0.11)**
Ryobi : eBay Sales	**1.72 (0.17)**	**-3.31 (0.19)**	**5.56 (3.62, 8.53)**	**0.037 (0.025, 0.05)**
Ryobi : Female	**0.37 (0.13)**	**-1.35 (0.11)**	**1.44 (1.03, 2.02)**	**0.259 (0.208, 0.32)**
Ryobi : High Income	0 (0.1)	0.74 (0.08)	1 (0.78, 1.27)	2.09 (1.779, 2.45)
Ryobi : Low Income	**0.07 (0.09)**	**-1.61 (0.08)**	**1.07 (0.84, 1.36)**	**0.201 (0.172, 0.23)**
Ryobi : Not Cordless	1.05 (0.12)	3.1 (0.11)	2.84 (2.07, 3.91)	22.099 (17.685, 27.61)
Ryobi : Phone	-0.78 (0.17)	-3.25 (0.18)	0.46 (0.30, 0.71)	0.039 (0.027, 0.06)
Ryobi : Reconditioned	2.09 (0.12)	2.23 (0.11)	8.09 (5.87, 11.16)	9.267 (7.431, 11.56)
Ryobi : Sex Not Known	**0.03 (0.13)**	**-1.92 (0.11)**	**1.03 (0.73, 1.45)**	**0.146 (0.117, 0.18)**
Senco : agg_channel	**0.43 (0.21)**	**-4.73 (0.23)**	**1.54 (0.90, 2.64)**	**0.009 (0.006, 0.01)**
Senco : Amazon Sales	**0.54 (0.17)**	**-3.41 (0.19)**	**1.72 (1.11, 2.66)**	**0.033 (0.023, 0.05)**
Senco : eBay Sales	**1.15 (0.19)**	**-4.61 (0.21)**	**3.16 (1.96, 5.09)**	**0.01 (0.007, 0.01)**
Senco : Female	**0.03 (0.15)**	**-1.69 (0.13)**	**1.03 (0.71, 1.49)**	**0.184 (0.143, 0.24)**
Senco : High Income	0.27 (0.11)	1.01 (0.1)	1.31 (0.98, 1.74)	2.744 (2.273, 3.31)
Senco : Low Income	**0.09 (0.1)**	**-1.59 (0.09)**	**1.09 (0.84, 1.42)**	**0.205 (0.173, 0.24)**
Senco : Not Cordless	0.87 (0.13)	2.93 (0.12)	2.4 (1.70, 3.39)	18.692 (14.782, 23.64)
Senco : Phone	**0.16 (0.18)**	**-3.05 (0.18)**	**1.17 (0.75, 1.85)**	**0.047 (0.033, 0.07)**
Senco : Reconditioned	0.76 (0.12)	0.89 (0.11)	2.13 (1.55, 2.93)	2.445 (1.975, 3.03)
Senco : Sex Not Known	-0.16 (0.15)	-2.11 (0.13)	0.85 (0.58, 1.24)	0.121 (0.094, 0.16)
Sex Not Known : Not Cordless	-0.1 (0.06)	-0.1 (0.05)	0.9 (0.78, 1.04)	0.907 (0.819, 1)
Sex Not Known : Reconditioned	-0.11 (0.05)	-0.1 (0.05)	0.9 (0.79, 1.02)	0.901 (0.82, 0.99)
Skil : agg_channel	-0.27 (0.16)	-1.81 (0.14)	0.76 (0.50, 1.16)	0.163 (0.125, 0.21)
Skil : Amazon Sales	-0.11 (0.15)	-0.45 (0.12)	0.89 (0.61, 1.31)	0.637 (0.505, 0.8)
Skil : eBay Sales	**0.59 (0.15)**	**-1.56 (0.12)**	**1.8 (1.21, 2.68)**	**0.21 (0.164, 0.27)**
Skil : Female	**0.57 (0.12)**	**-1.15 (0.1)**	**1.77 (1.30, 2.41)**	**0.317 (0.263, 0.38)**
Skil : High Income	0.14 (0.09)	0.88 (0.07)	1.15 (0.92, 1.45)	2.411 (2.093, 2.78)
Skil : Low Income	**0.13 (0.08)**	**-1.54 (0.07)**	**1.14 (0.92, 1.42)**	**0.214 (0.187, 0.24)**
Skil : Not Cordless	0.07 (0.1)	2.12 (0.09)	1.07 (0.83, 1.39)	8.291 (7.015, 9.8)
Skil : Reconditioned	0.23 (0.1)	0.37 (0.08)	1.26 (0.97, 1.63)	1.448 (1.231, 1.7)
Skil : Sex Not Known	-0.1 (0.12)	-2.05 (0.1)	0.9 (0.66, 1.23)	0.128 (0.106, 0.16)

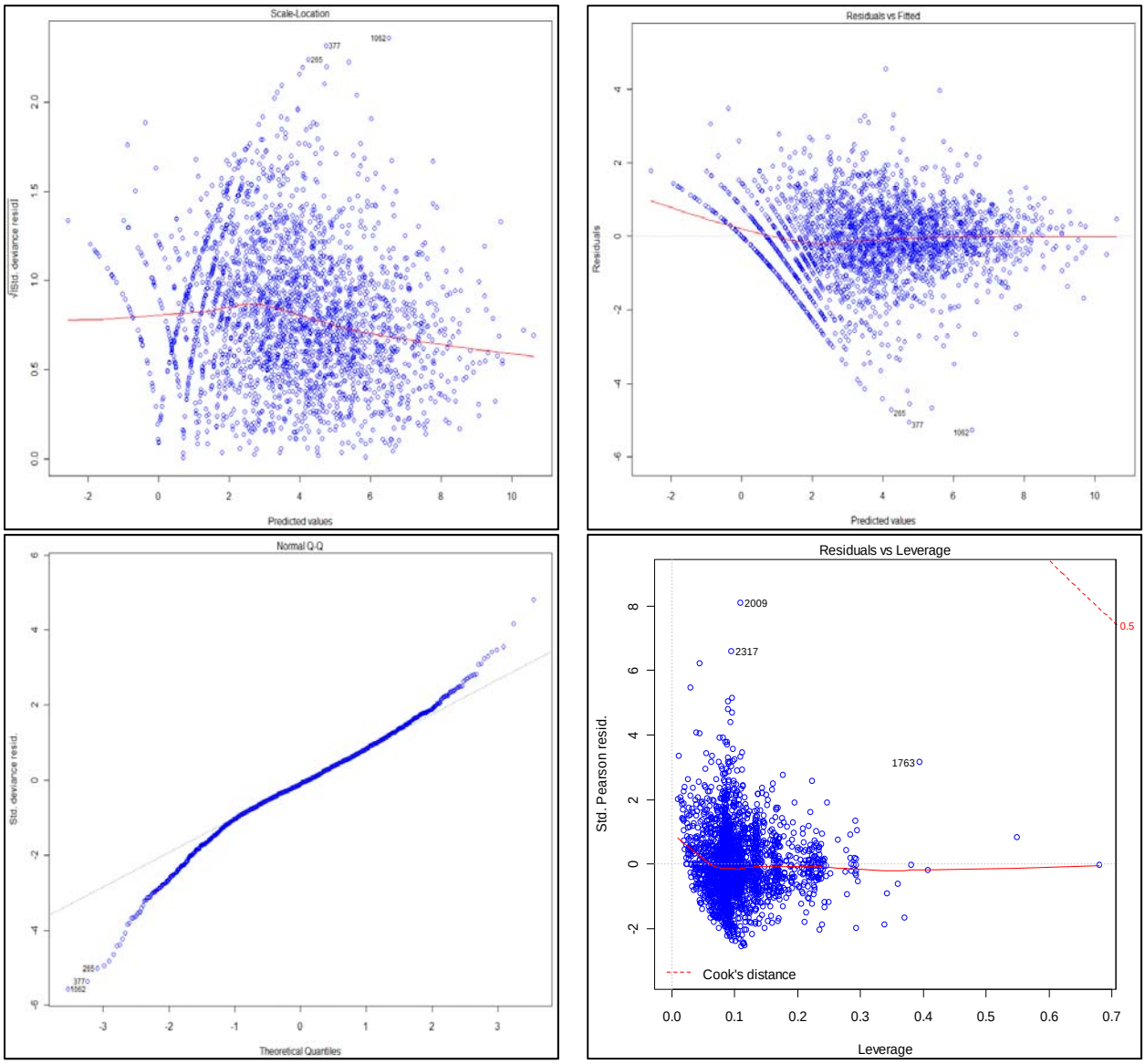
Table 9. Additional parameters output by `glm.nb`.

* All estimates are rounded to the 2nd decimal.

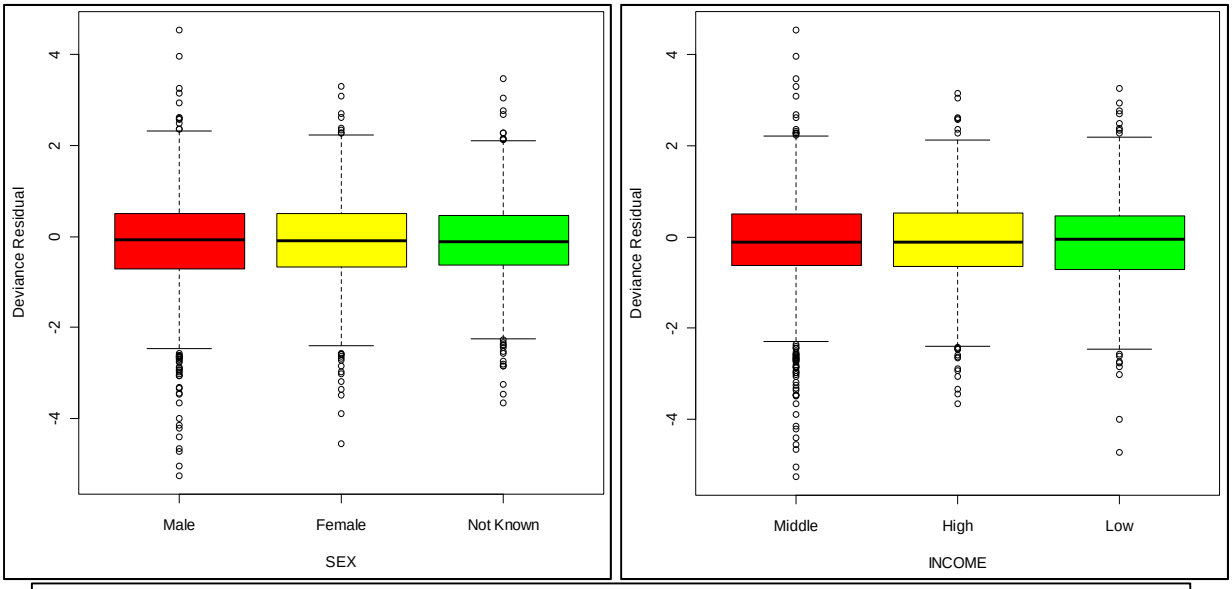
Parameters	coef (se)	Odds ratio (95% CI)
Black & Decker : Branded Web	1.13 (0.15)*	3.09 (2.31, 4.14)
Bosch : agg_channel	-0.64 (0.16)	0.53 (0.39, 0.71)
Bosch : Amazon Sales	0.56 (0.15)	1.76 (1.32, 2.35)
Bosch : Branded Web	2.64 (0.15)	13.95 (10.47, 18.58)
Bosch : eBay Sales	-1.25 (0.15)	0.29 (0.21, 0.39)
Bosch : Female	-1.72 (0.09)	0.18 (0.15, 0.22)
Bosch : High Income	0.74 (0.07)	2.1 (1.83, 2.41)
Bosch : Low Income	-1.67 (0.07)	0.19 (0.16, 0.21)
Bosch : Not Cordless	2.05 (0.08)	7.78 (6.61, 9.16)
Bosch : Phone	1.3 (0.14)	3.68 (2.82, 4.8)
Bosch : Reconditioned	0.14 (0.08)	1.15 (0.98, 1.35)
Bosch : Sex Not Known	-1.95 (0.09)	0.14 (0.12, 0.17)
Bostitch : Branded Web	2.65 (0.17)	14.13 (10.19, 19.59)
Campbell Hausfeld : Branded Web	-0.68 (0.16)	0.51 (0.37, 0.69)
Delta : Branded Web	3.21 (0.18)	24.68 (17.44, 34.91)
Dewalt : Branded Web	2.21 (0.15)	9.1 (6.81, 12.16)
Fein : Branded Web	-2.5 (0.24)	0.08 (0.05, 0.13)
Festool : Branded Web	-1.45 (0.21)	0.23 (0.15, 0.35)
Homelite : Branded Web	-3.75 (0.46)	0.02 (0.01, 0.06)
Jet : Branded Web	2.67 (0.2)	14.41 (9.75, 21.3)
Karcher : Branded Web	-2.31 (0.37)	0.1 (0.05, 0.21)
Makita : Branded Web	2.09 (0.15)	8.11 (6.07, 10.83)
Metabo : Branded Web	-1.8 (0.21)	0.17 (0.11, 0.25)
Milwaukee : Branded Web	2.92 (0.15)	18.59 (13.94, 24.78)
Panasonic : Branded Web	-0.38 (0.17)	0.68 (0.49, 0.96)
Porter Cable : Branded Web	1.77 (0.15)	5.86 (4.38, 7.86)
Powermatic : Branded Web	0.7 (0.21)	2.01 (1.32, 3.06)
Ridgid : Branded Web	0.59 (0.16)	1.8 (1.31, 2.48)
Ryobi : Branded Web	-1.14 (0.19)	0.32 (0.22, 0.46)
Senco : Branded Web	-1.88 (0.18)	0.15 (0.11, 0.22)
Skil : Branded Web	1.73 (0.12)	5.64 (4.5, 7.07)

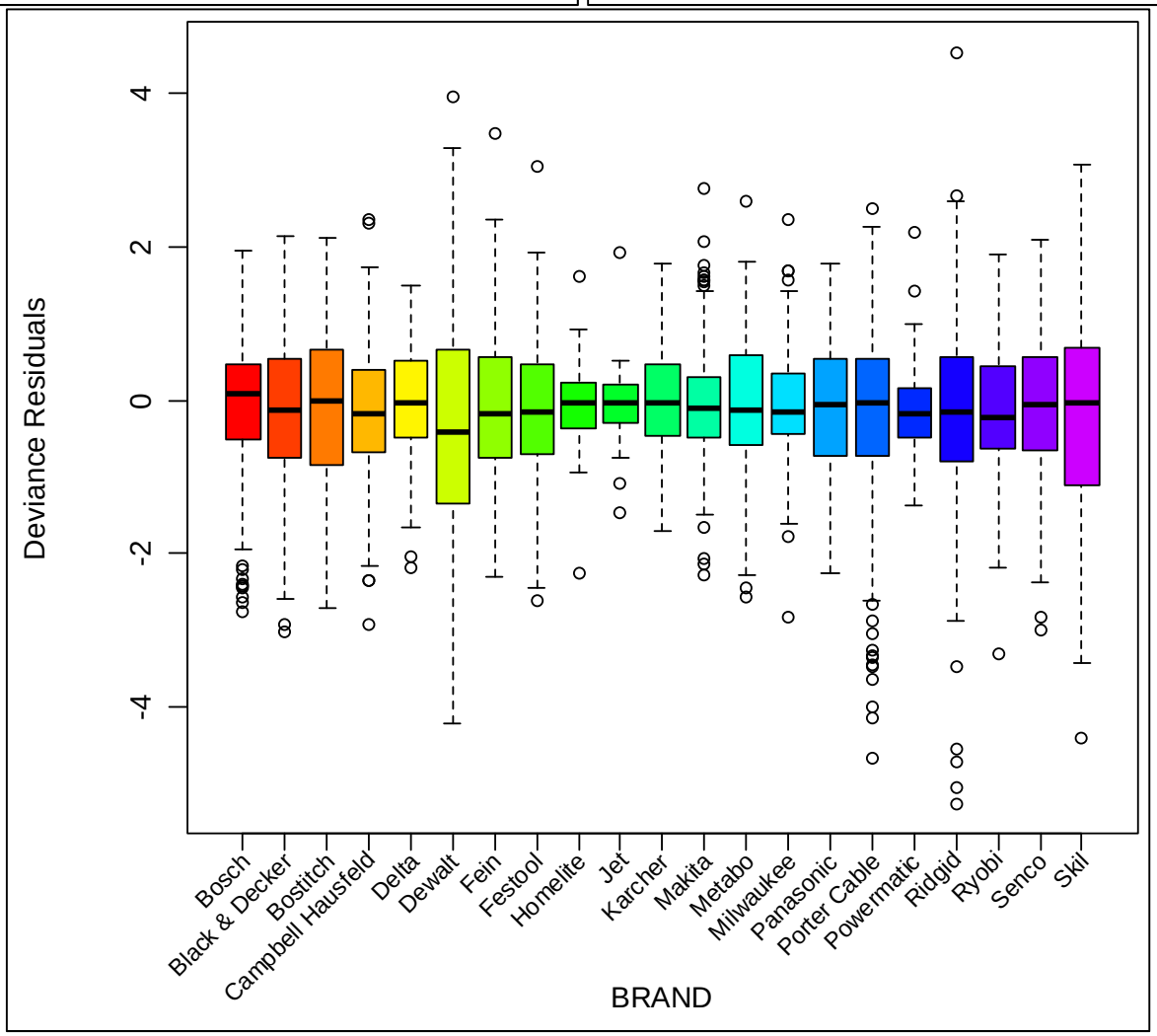
Appendix 1-B: `glm.nb`

1-B.1: Residual Diagnostics

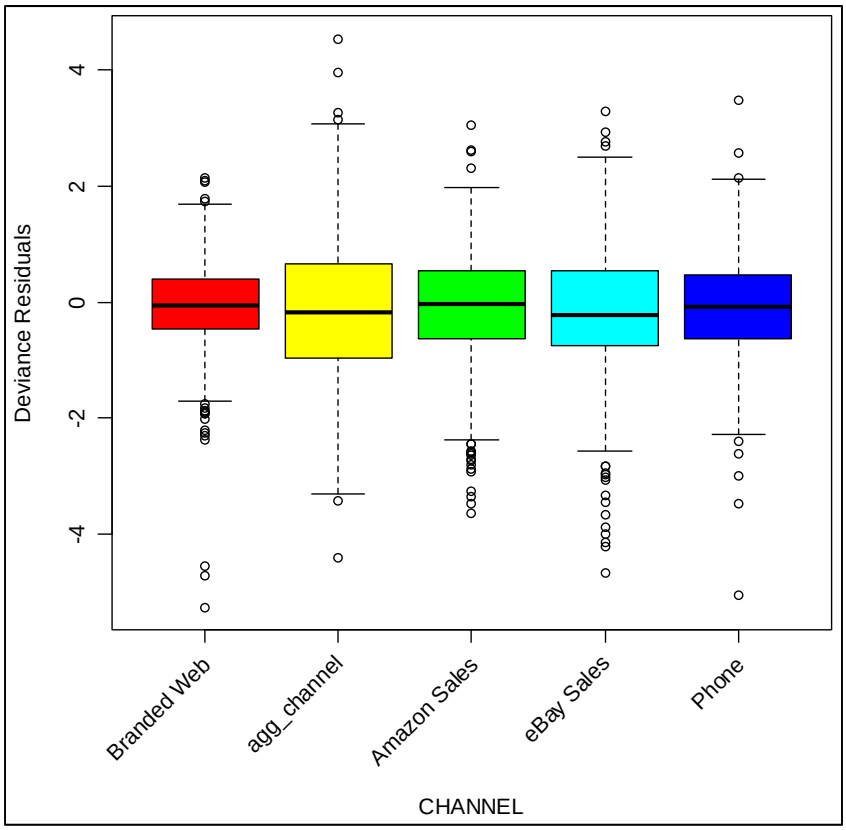


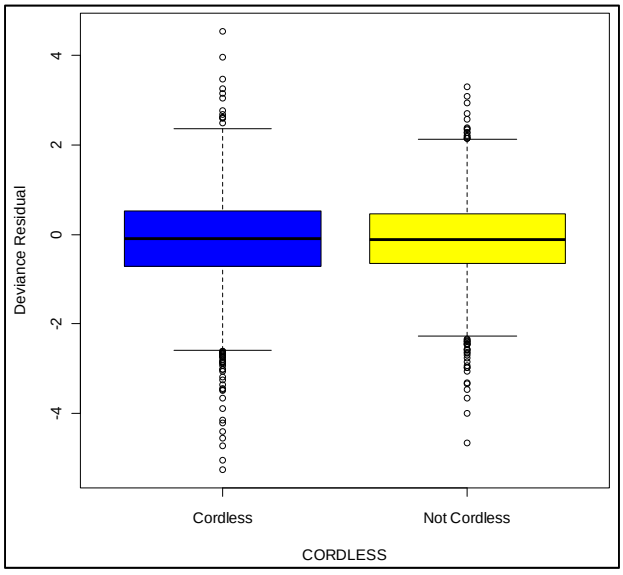
1-B.2: Univariate standardized deviance residual boxplots (Sex, Income, and Brand)

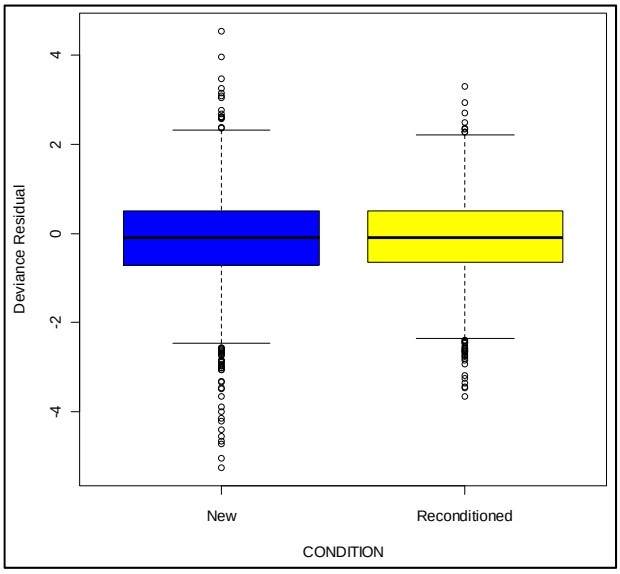




1-B.3: Univariate standardized deviance residual boxplots (Channel, Cordless, and Condition)

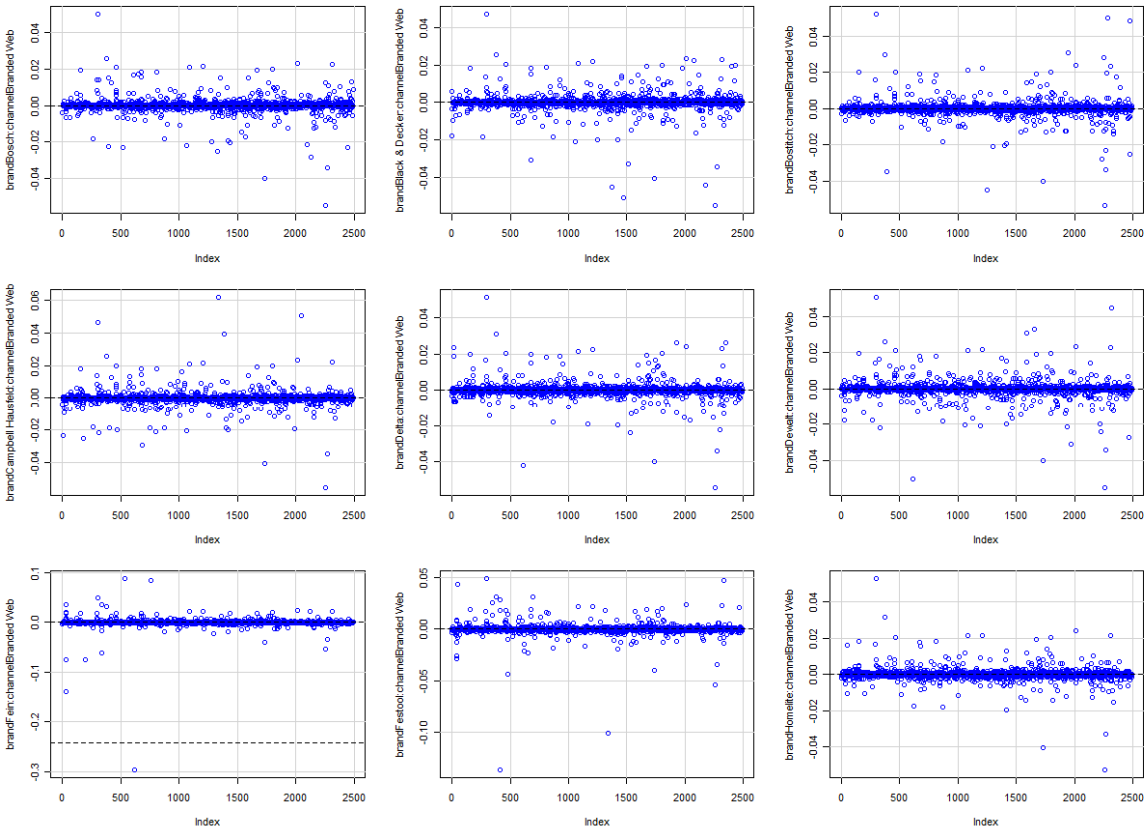


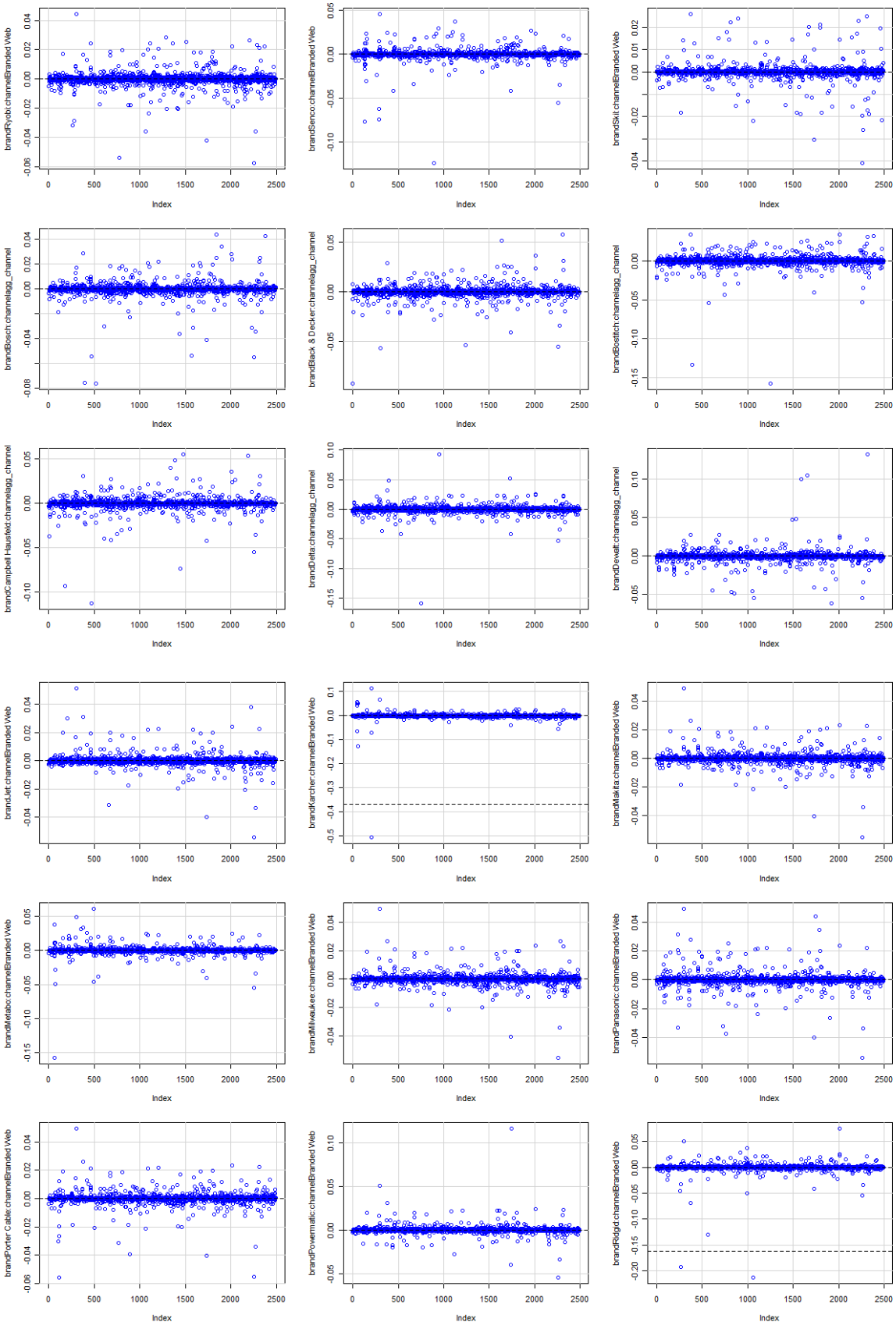




1-B.4: DF Beta Plots

Description from the R Documentation: “These functions display index plots of dfbeta (effect on coefficients of deleting each observation in turn) and dfbetas (effect on coefficients of deleting each observation in turn, standardized by a deleted estimate of the coefficient standard error). In the plot of dfbeta, horizontal lines are drawn at 0 and +/- one standard error; in the plot of dfbetas, horizontal lines are drawn and 0 and +/- 1.” **http://hosho.ees.hokudai.ac.jp/~kubo/Rdoc/library/car/html/dfbetaPlots.html**

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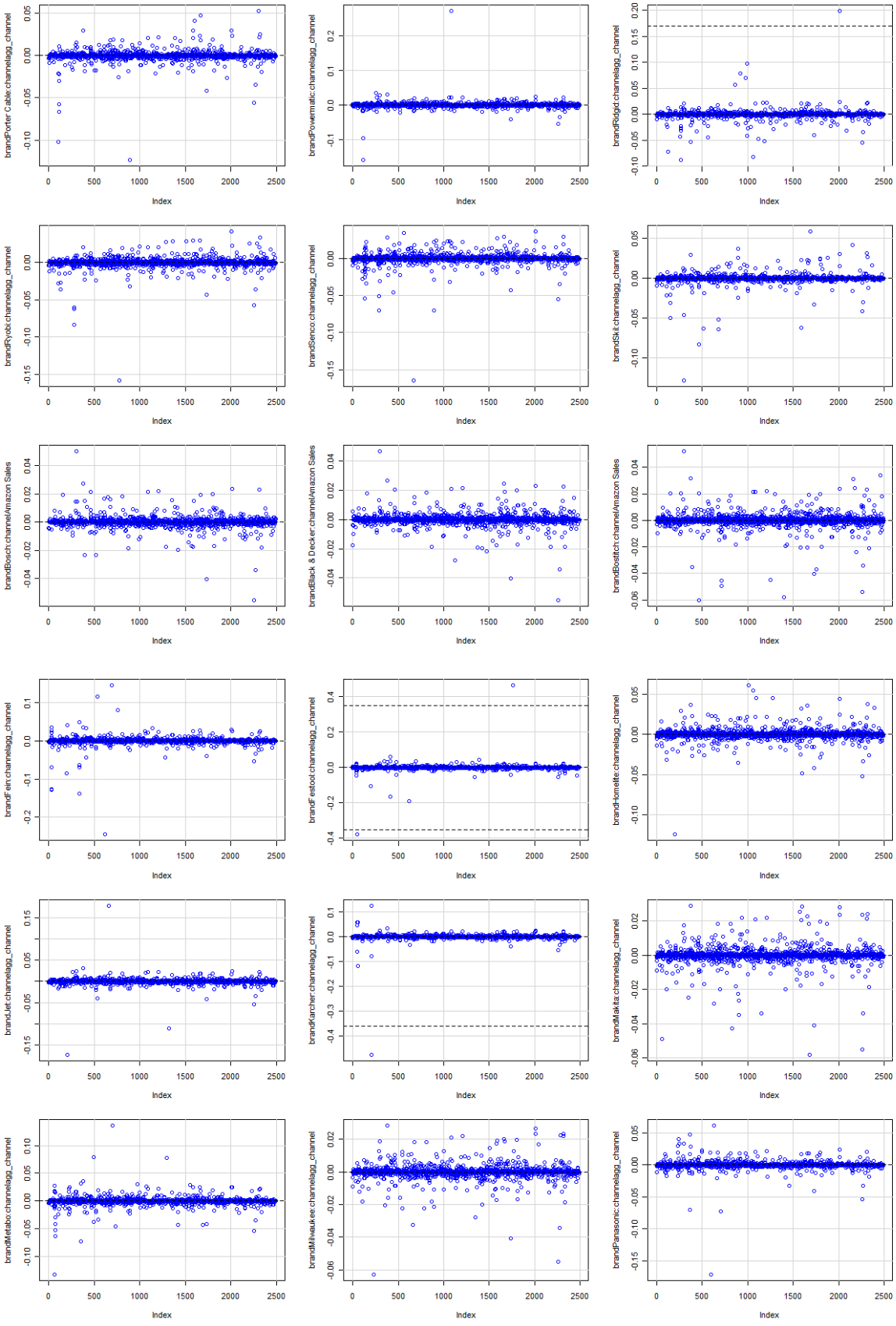
brandBostitch.channelagg_channel
brandCampbell Hausfeld.channelagg_channel
brandDelta.channelagg_channel
brandDewalt.channelagg_channel
brandJet.channelBranded.Web
brandKarcher.channelBranded.Web
brandMakita.channelBranded.Web
brandMetabo.channelBranded.Web
brandMilwaukee.channelBranded.Web
brandPanasonic.channelBranded.Web
brandPorter Cable.channelBranded.Web
brandPowermatic.channelBranded.Web
brandRidgid.channelBranded.Web
Index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brandRidgid:channelagg_channel
brandRyobi:channelagg_channel
brandSenco:channelagg_channel
brandSkil:channelagg_channel
brandBosch:channel/Amazon Sales
brandBlack & Decker:channel/Amazon Sales
brandBostitch:channel/Amazon Sales
brandFein:channelagg_channel
brandFestool:channelagg_channel
brandHomelite:channelagg_channel
brandJet:channelagg_channel
brandKarcher:channelagg_channel
brandMakita:channelagg_channel
brandMetabo:channelagg_channel
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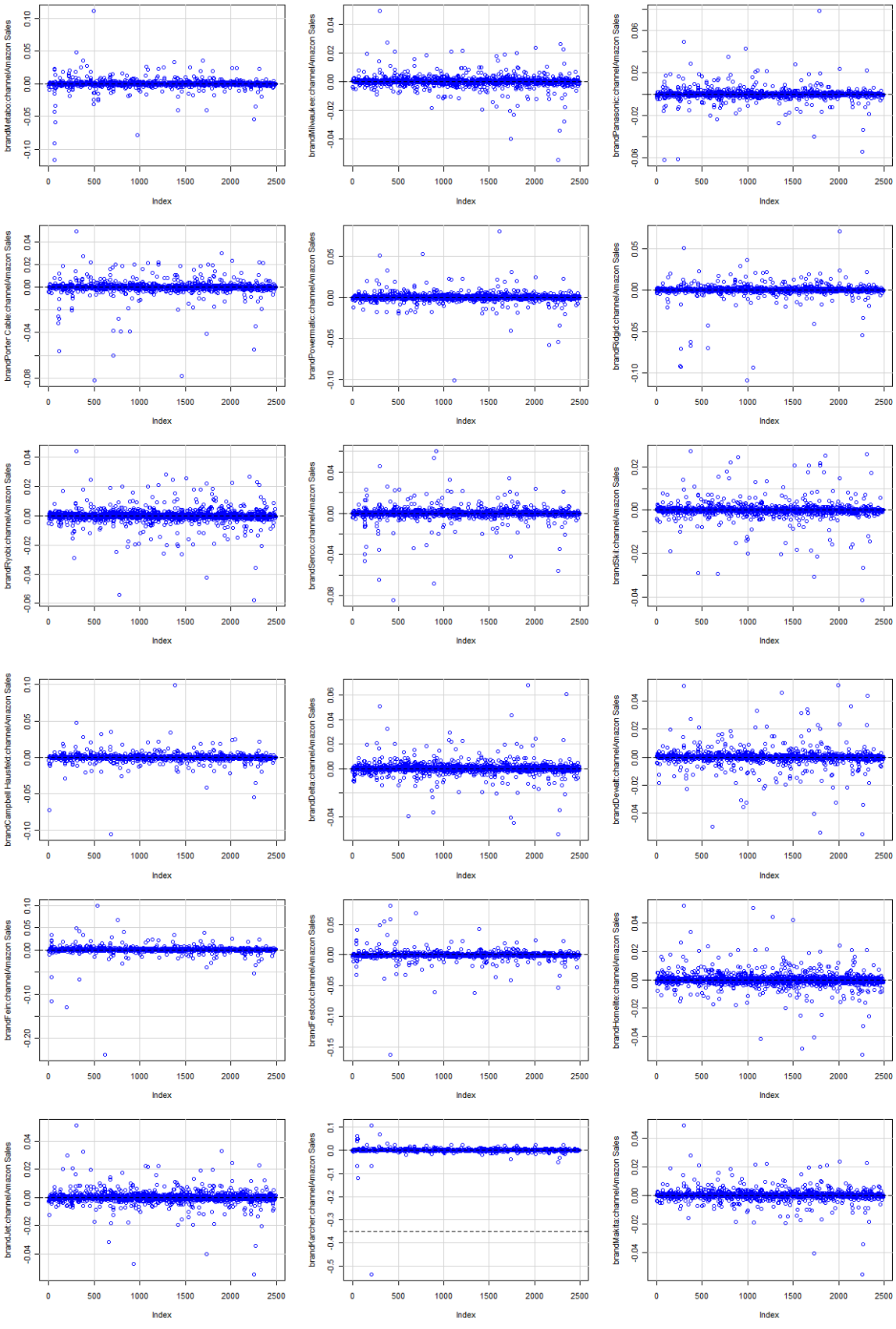
brandPanasonic:channelagg_channel
Index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brandPowermatic:channelAmazon Sales
brandRidgid:channelAmazon Sales
brandRyobi:channelAmazon Sales
brandSenco:channelAmazon Sales
brandSkil:channelAmazon Sales
brandCampbell Hausfeld:channelAmazon Sales
brandDelta:channelAmazon Sales
brandDewalt:channelAmazon Sales
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brandHomelite:channelAmazon Sales
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brandKarcher:channelAmazon Sales
brandMakita:channelAmazon Sales
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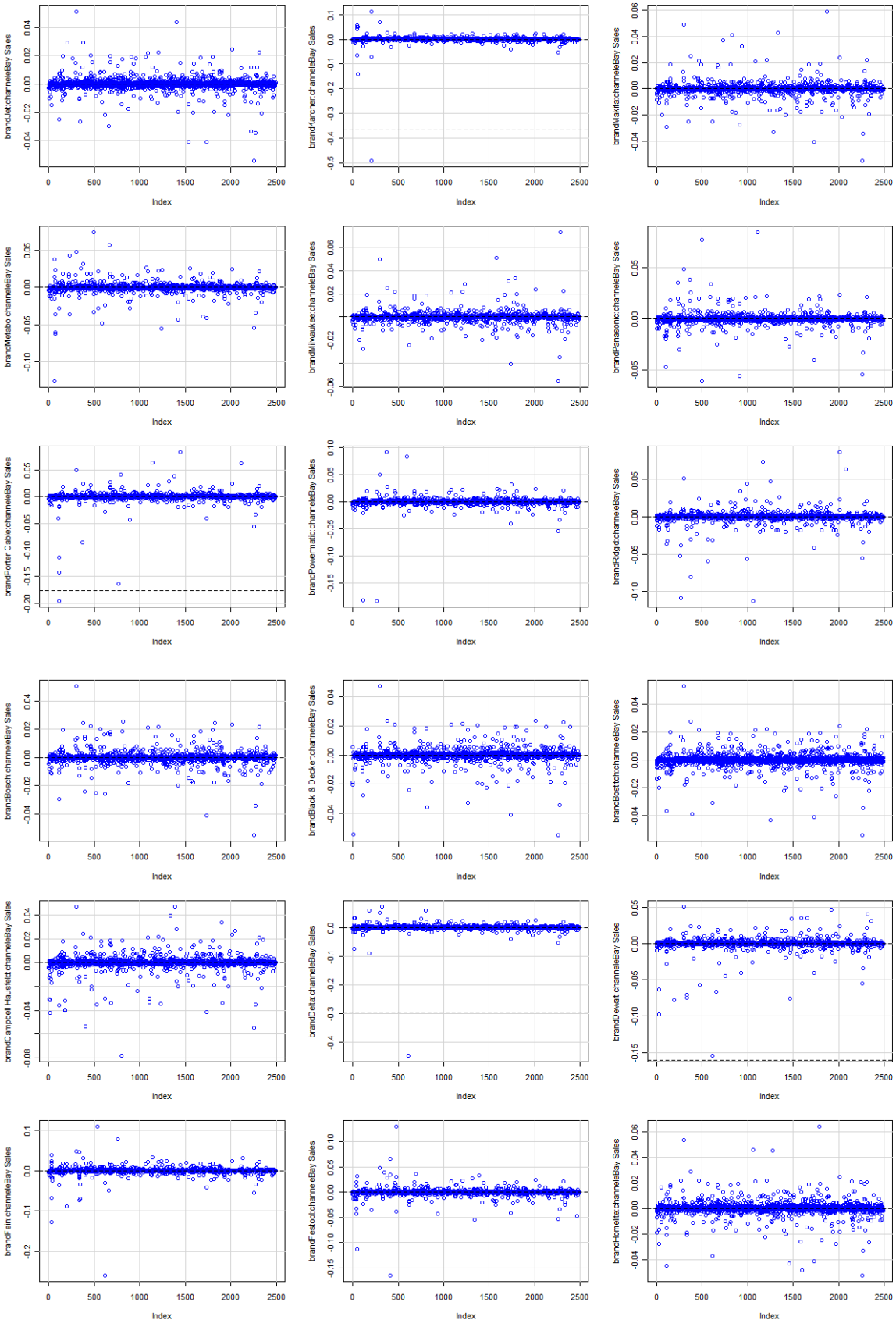
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brandKarcher:channeleBay Sales
brandMakita:channeleBay Sales
brandMetabo:channeleBay Sales
brandMilwaukee:channeleBay Sales
brandPanasonic:channeleBay Sales
brandPorter Cable:channeleBay Sales
brandPowermatic:channeleBay Sales
brandRidgid:channeleBay Sales
brandBosch:channeleBay Sales
brandBlack & Decker:channeleBay Sales
brandBostitch:channeleBay Sales
brandCampbell Hausfeld:channeleBay Sales
brandDelta:channeleBay Sales
brandDewalt:channeleBay Sales
brandFein:channeleBay Sales
brandFestool:channeleBay Sales
brandHomelite:channeleBay Sales
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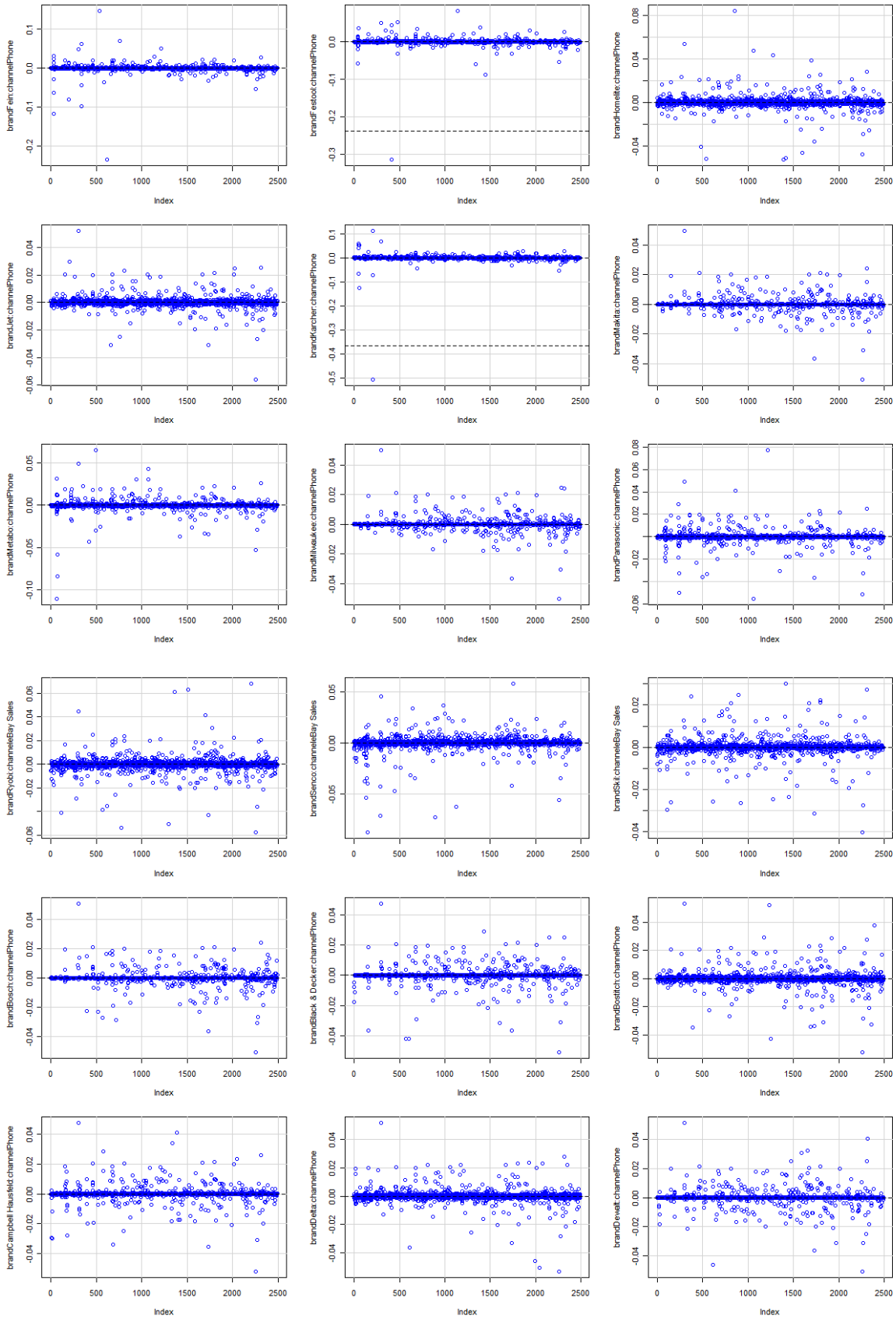
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brandHonelite:channelPhone
brandJet:channelPhone
brandKarcher:channelPhone
brandMakita:channelPhone
brandMetabo:channelPhone
brandMilwaukee:channelPhone
brandPanasonic:channelPhone
brandRyobi:channeleBay Sales
brandSenco:channeleBay Sales
brandSkil:channeleBay Sales
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brandBostitch:channelPhone
brandCampbell Hausfeld:channelPhone
brandDelta:channelPhone
brandDewalt:channelPhone
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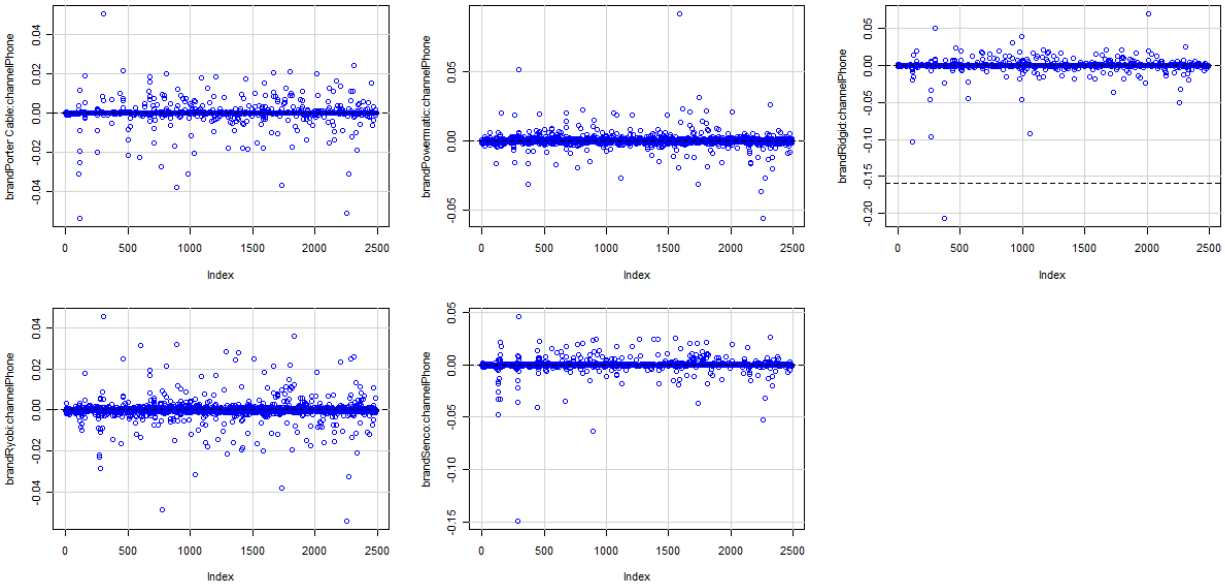
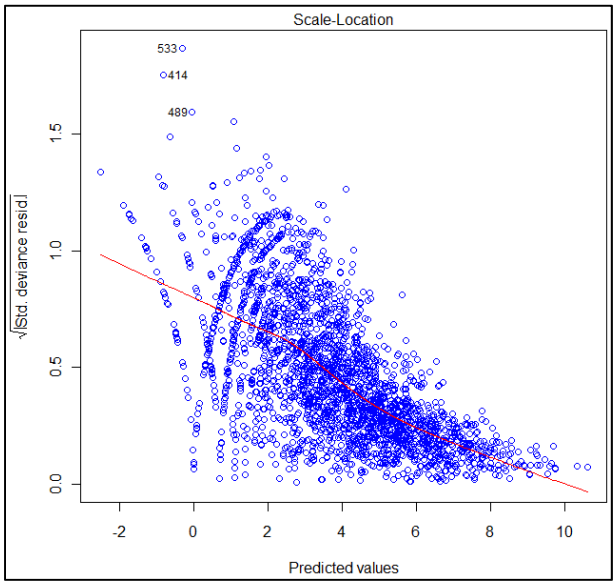
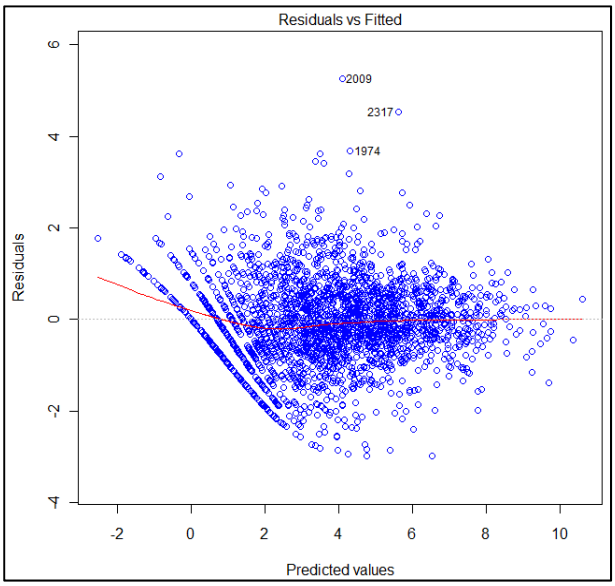
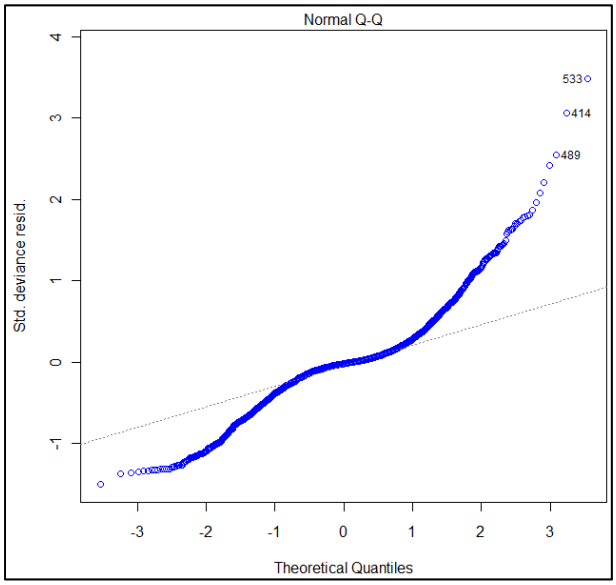

brandPorter Cable:channelPhone
brandPowermatic:channelPhone
brandRidgid:channelPhone
brandRyobi:channelPhone
brandSenco:channelPhone
Index

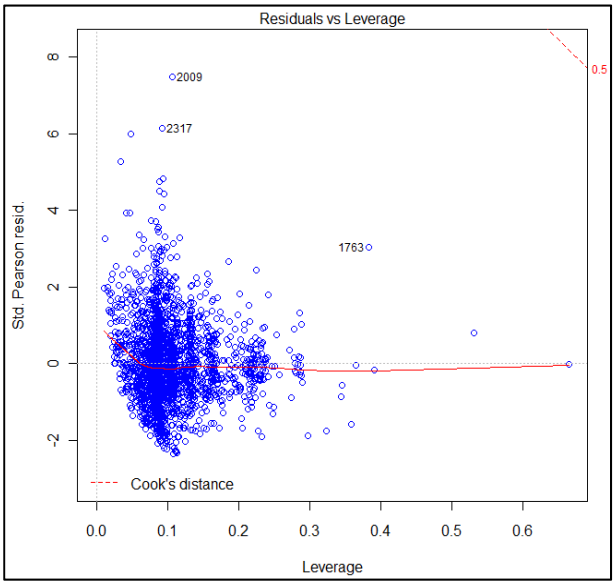
Appendix 1-C: `glm.poisson.disp`

1-C.1: Residual Diagnostics

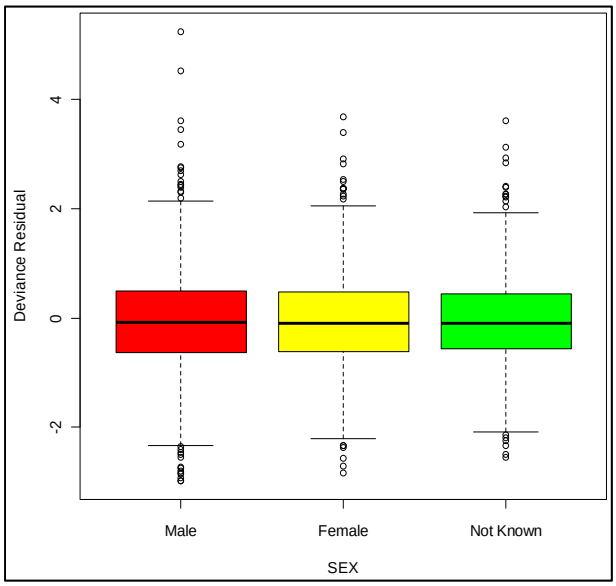


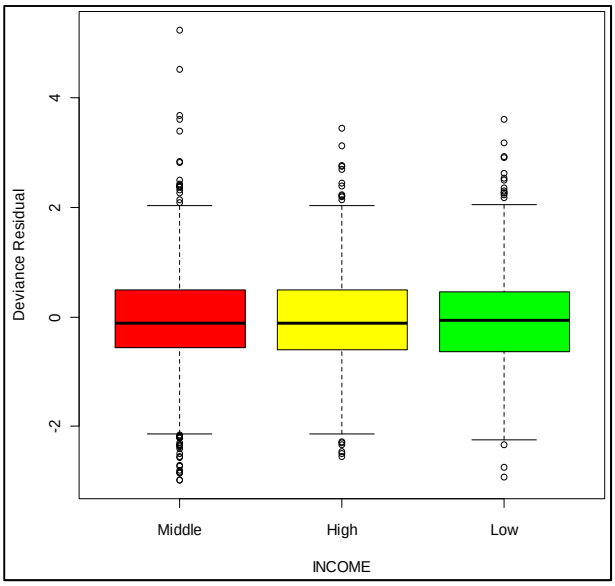


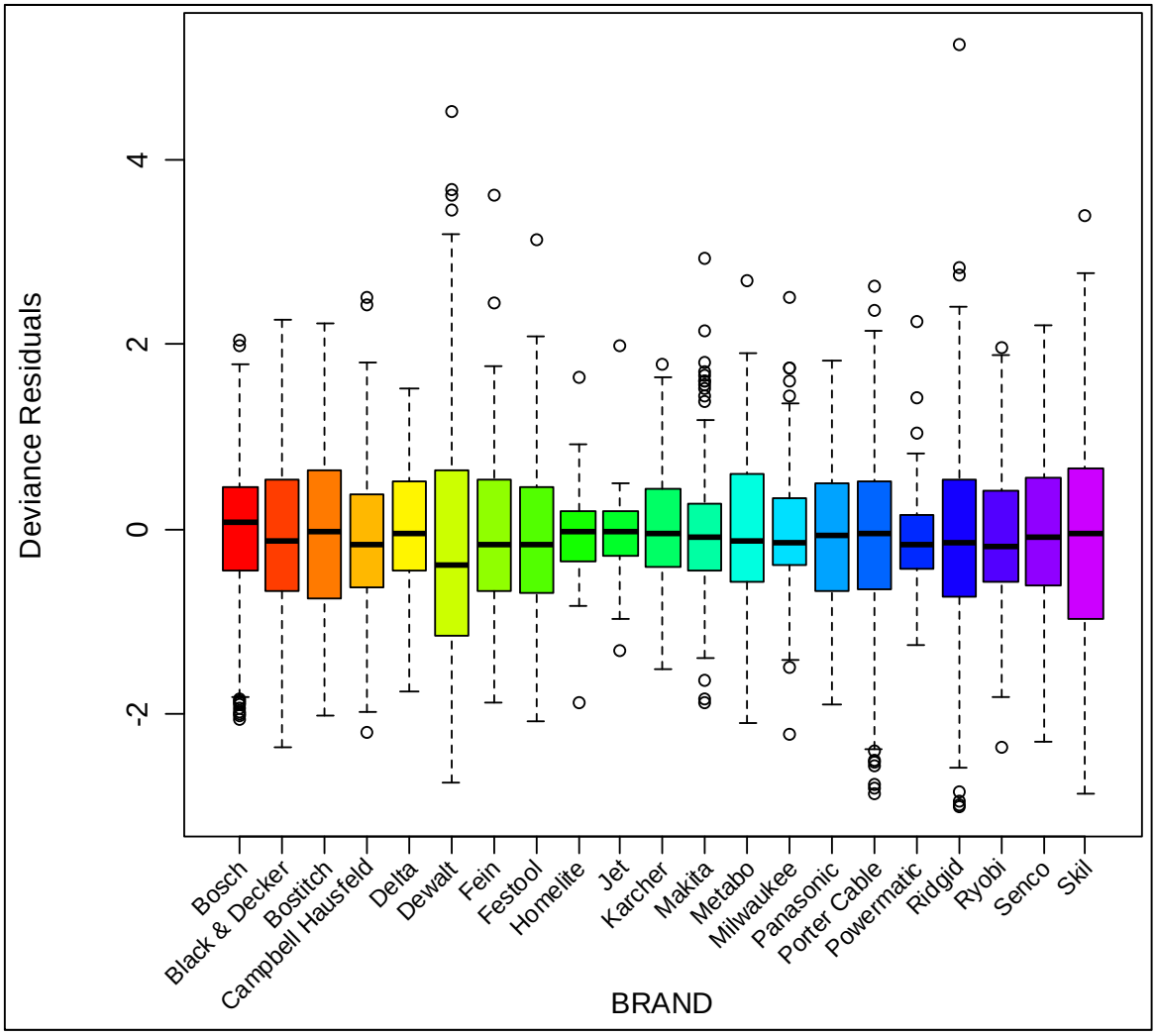




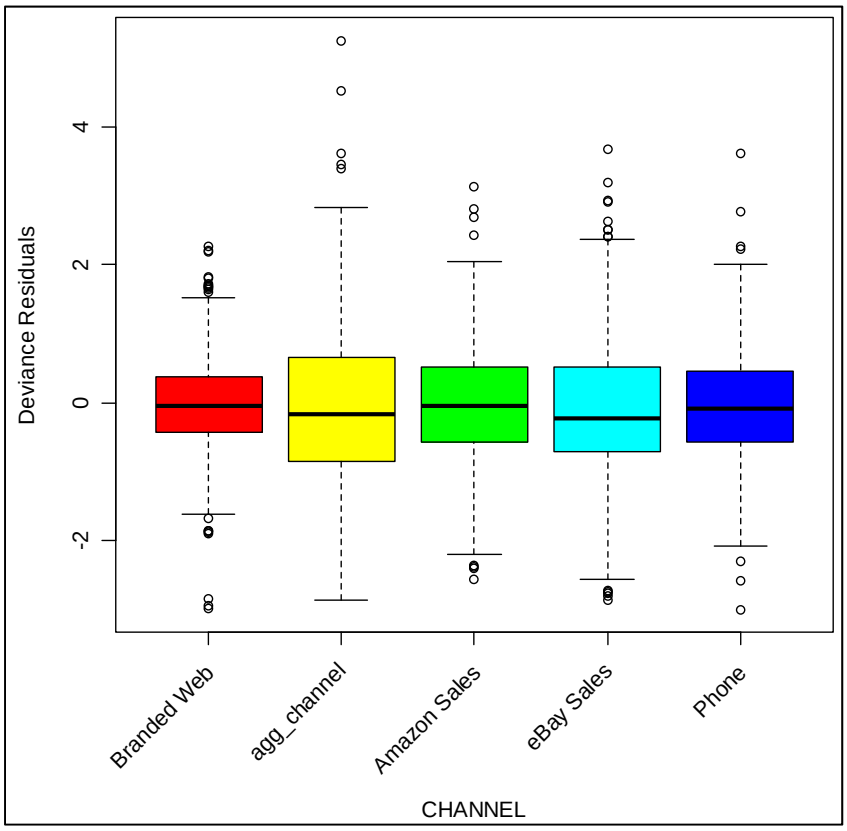
1-C.2: Univariate standardized deviance residual boxplots (Sex, Income, and Brand)

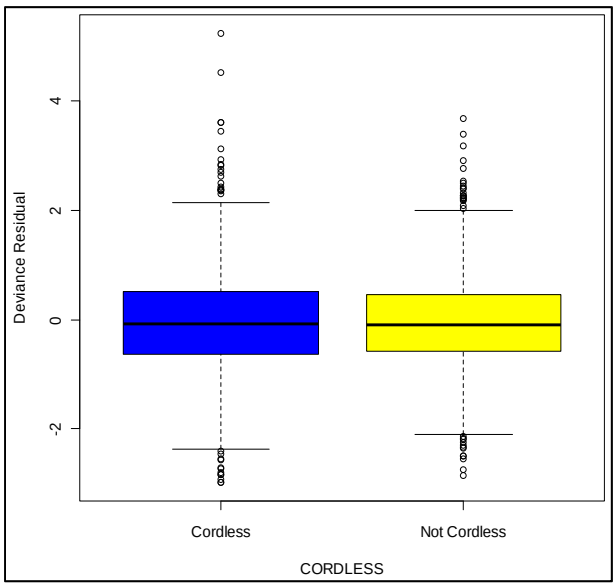


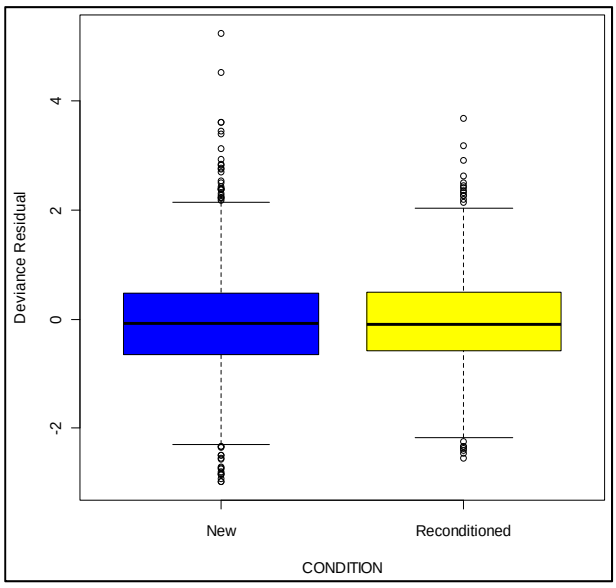




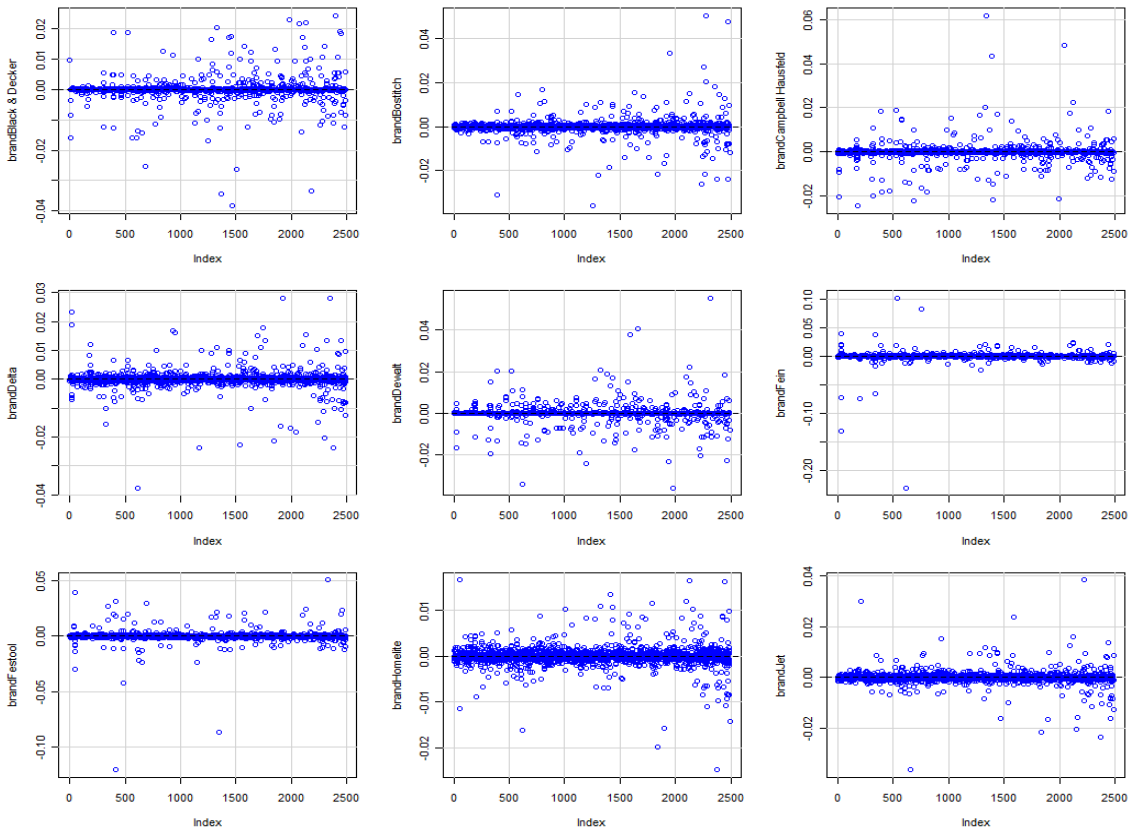
1-C.3: Univariate standardized deviance residual boxplots (Channel, Cordless, and Condition)

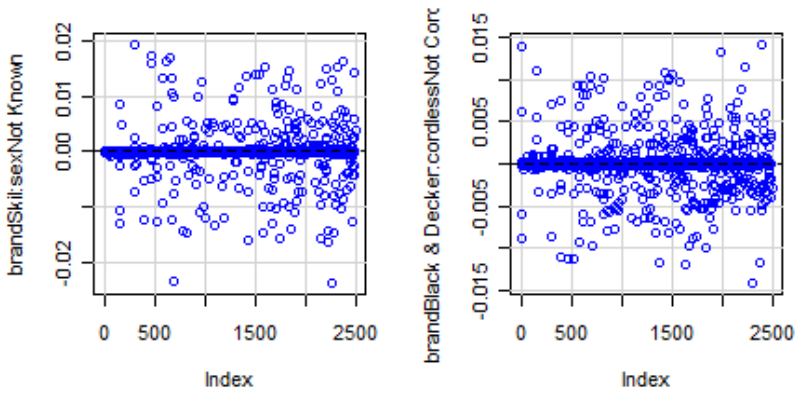


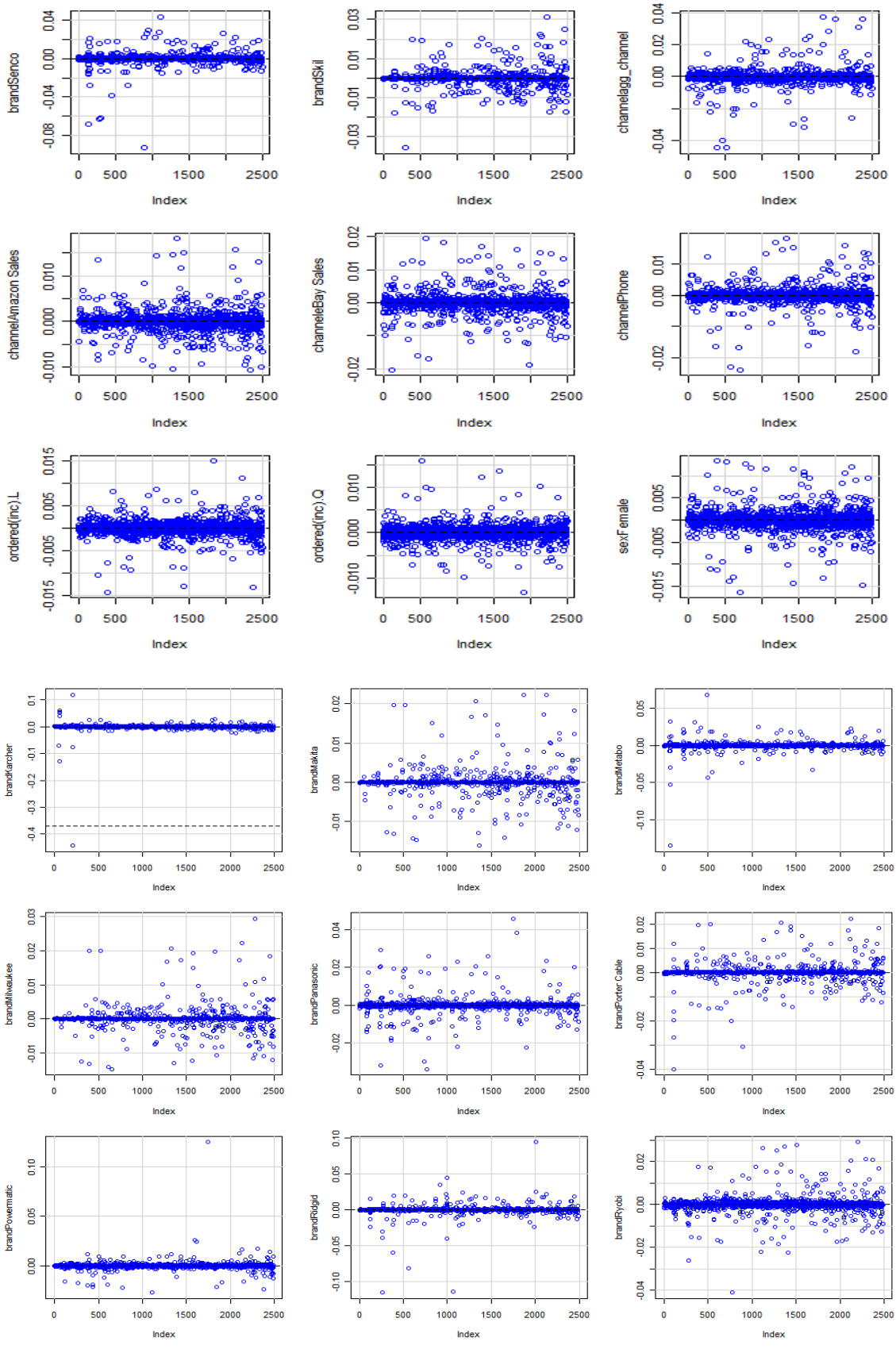


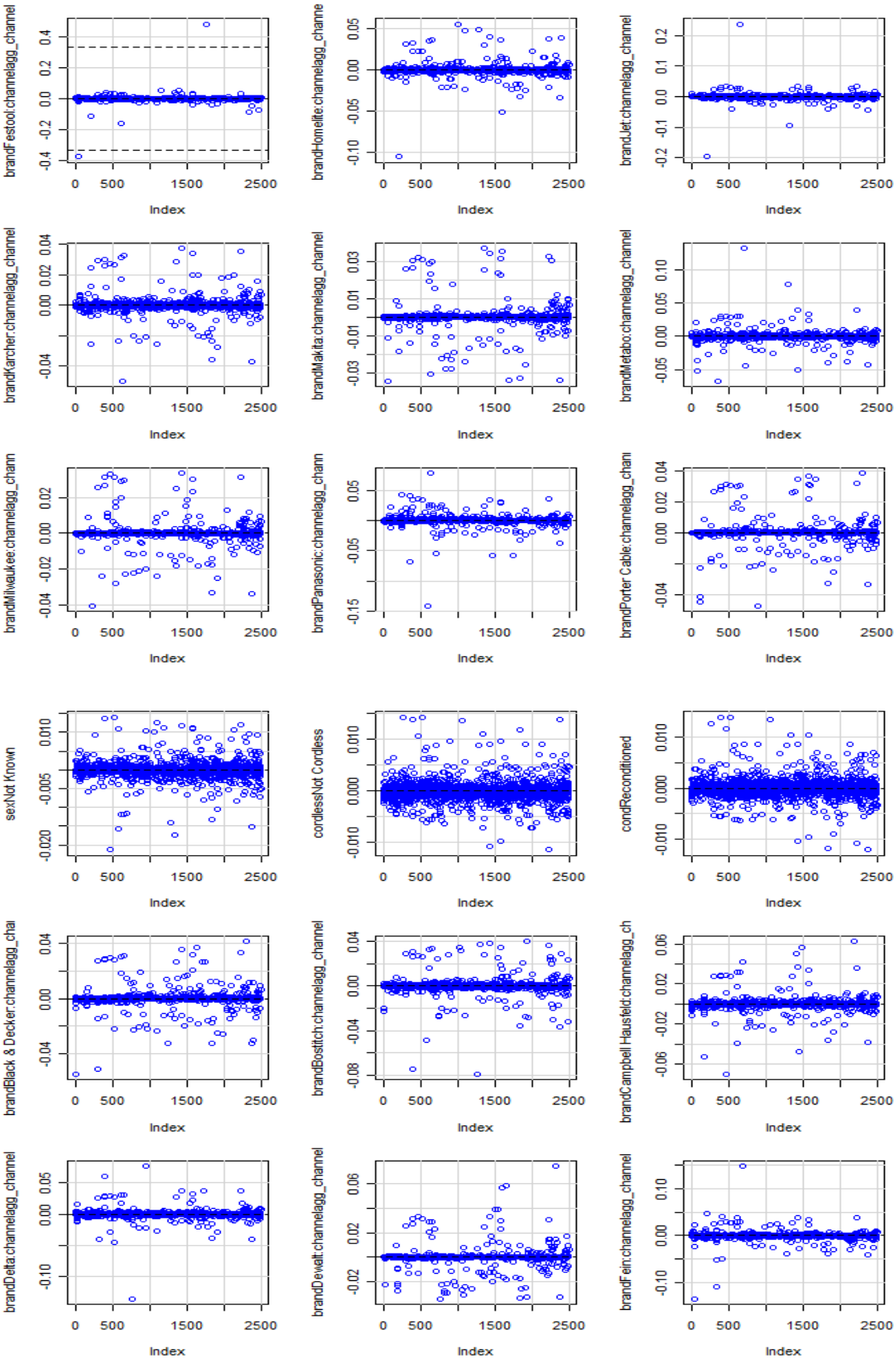


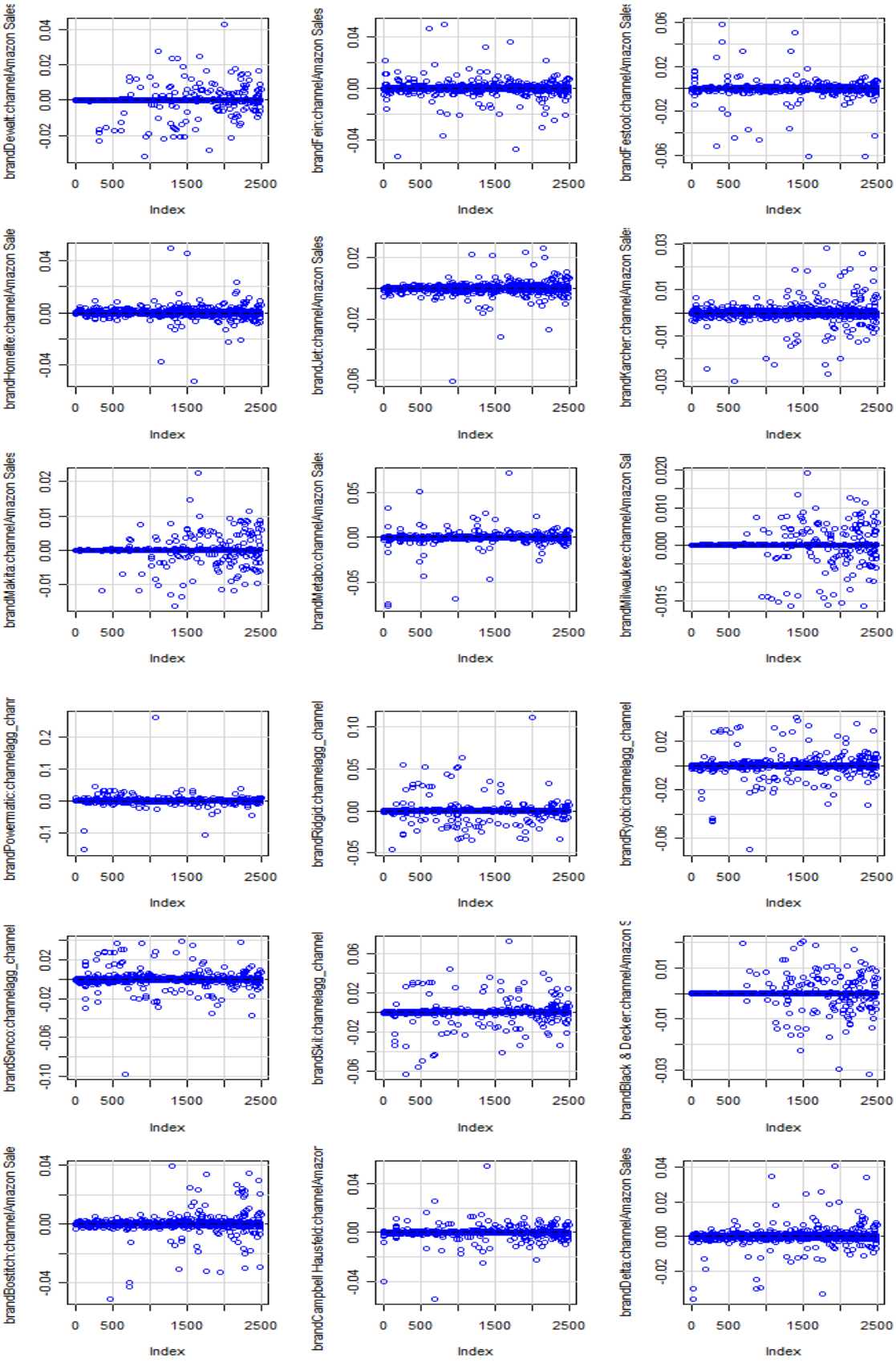
1-C.4: DF Beta Plots






brandSenco
brandSkil
channelagg_channel
channelAmazon Sales
channeleBay Sales
channelPhone
ordered(inc).L
ordered(inc).Q
sexFemale
brandKarcher
brandMakita
brandMetabo
brandMilwaukee
brandPanasonic
brandPorter Cable
brandPowermatic
brandRidgid
brandRyobi
Index


brandFestool:channelagg_channel
brandHomelite:channelagg_channe
brandJet:channelagg_channel
brandKarcher:channelagg_channel
brandMakita:channelagg_channel
brandMetabo:channelagg_channel
brandMilwaukee:channelagg_chann
brandPanasonic:channelagg_chann
brandPorter Cable:channelagg_chani
sexNot Known
cordlessNot Cordless
condReconditioned
brandBlack & Decker:channelagg_chai
brandBostitch:channelagg_channel
brandCampbell Hausfeld:channelagg_ch
brandDelta:channelagg_channel
brandDewalt:channelagg_channel
brandFein:channelagg_channel
Index


brandDewalt:channelAmazon Sales
brandFein:channelAmazon Sales
brandFestool:channelAmazon Sales
brandHomelite:channelAmazon Sales
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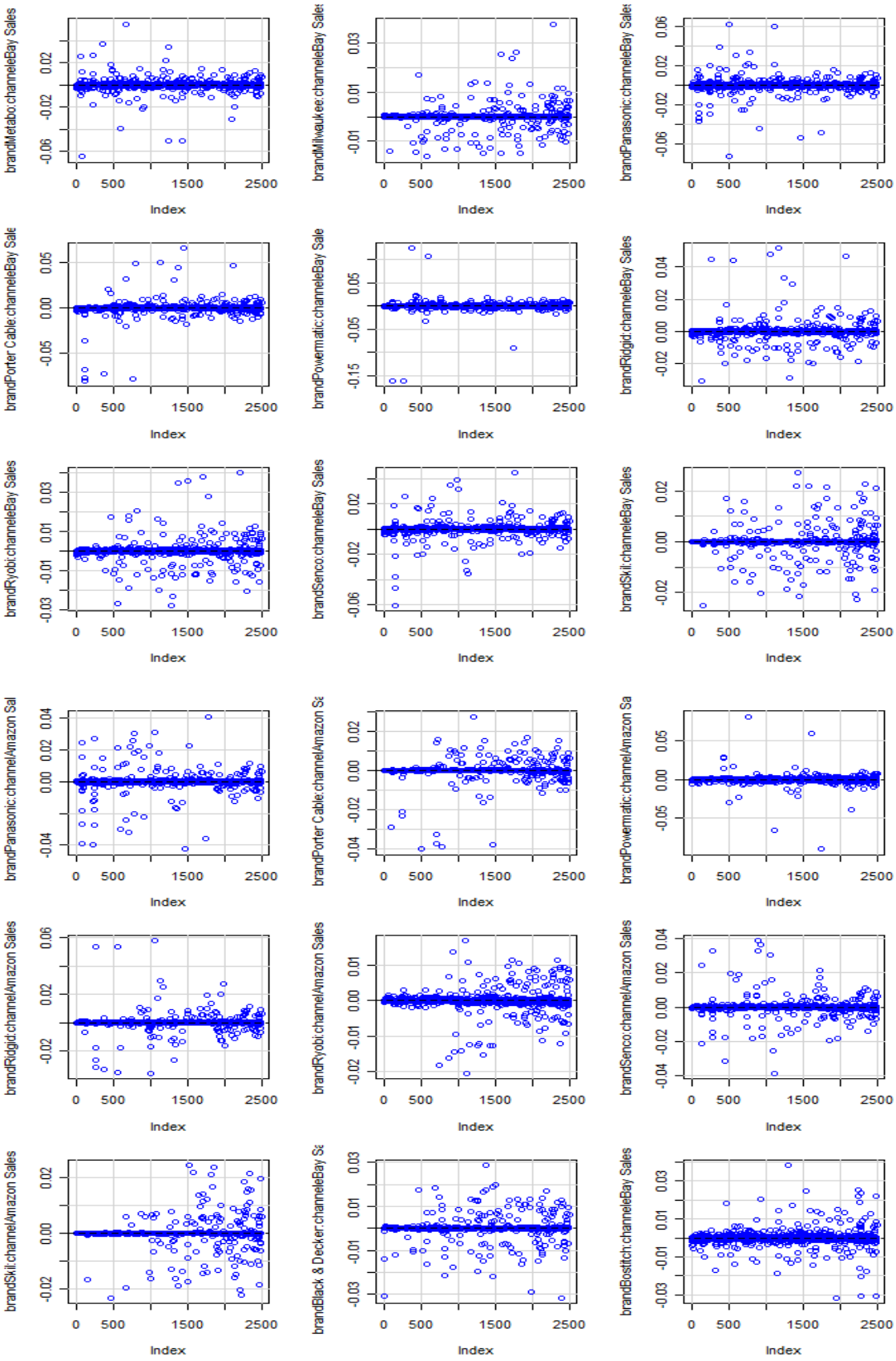
brandKarcher:channelAmazon Sales
brandMakita:channelAmazon Sales
brandMetabo:channelAmazon Sales
brandMilwaukee:channelAmazon Sal
brandPowermatic:channelagg_chanr
brandRidgid:channelagg_channel
brandRyobi:channelagg_channel
brandSenco:channelagg_channel
brandSkil:channelagg_channel
brandBlack & Decker:channelAmazon S
brandBostitch:channelAmazon Sales
brandCampbell Hausfeld:channelAmazor
brandDelta:channelAmazon Sales
Index


brandMetabo:channeleBay Sales
brandMilwaukee:channeleBay Sales
brandPanasonic:channeleBay Sales
brandPorter Cable:channeleBay Sales
brandPowermatic:channeleBay Sales
brandRidgid:channeleBay Sales
brandRyobi:channeleBay Sales
brandSenco:channeleBay Sales
brandSkil:channeleBay Sales
brandPanasonic:channel/Amazon Sales
brandPorter Cable:channel/Amazon Sales
brandPowermatic:channel/Amazon Sales
brandRidgid:channel/Amazon Sales
brandRyobi:channel/Amazon Sales
brandSenco:channel/Amazon Sales
brandSkil:channel/Amazon Sales
brandBlack & Decker:channeleBay Sales
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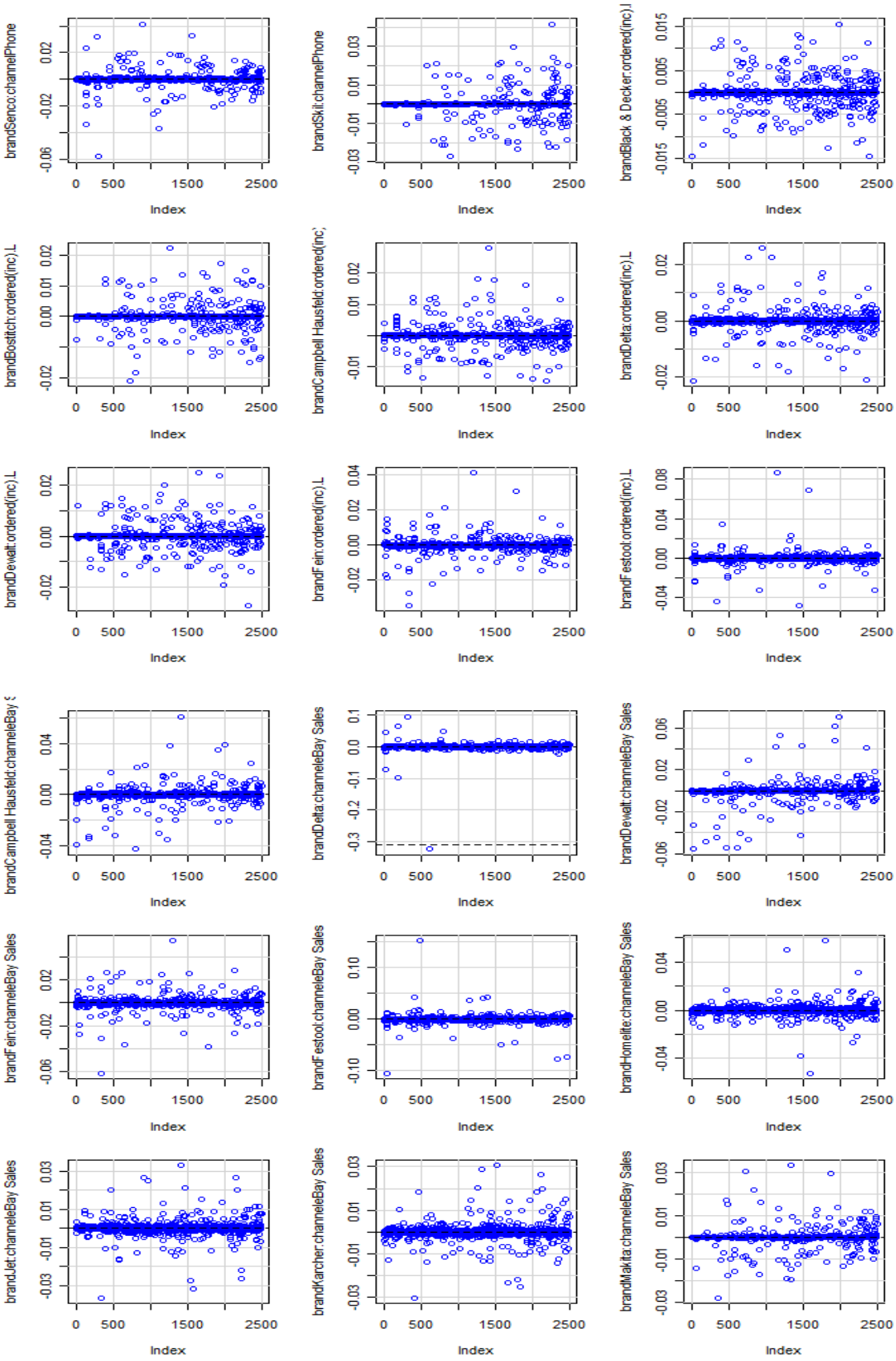
brandSenco:channelPhone
brandSkil:channelPhone
brandBlack & Decker:ordered(inc).l
brandBostitch:ordered(inc).L
brandCampbell Hausfeld:ordered(inc'
brandDelta:ordered(inc).L
brandDewalt:ordered(inc).L
brandFein:ordered(inc).L
brandFestool:ordered(inc).L
brandCampbell Hausfeld:channeleBay S
brandDelta:channeleBay Sales
brandDewalt:channeleBay Sales
brandFein:channeleBay Sales
brandFestool:channeleBay Sales
brandHomelite:channeleBay Sales
brandJet:channeleBay Sales
brandKarcher:channeleBay Sales
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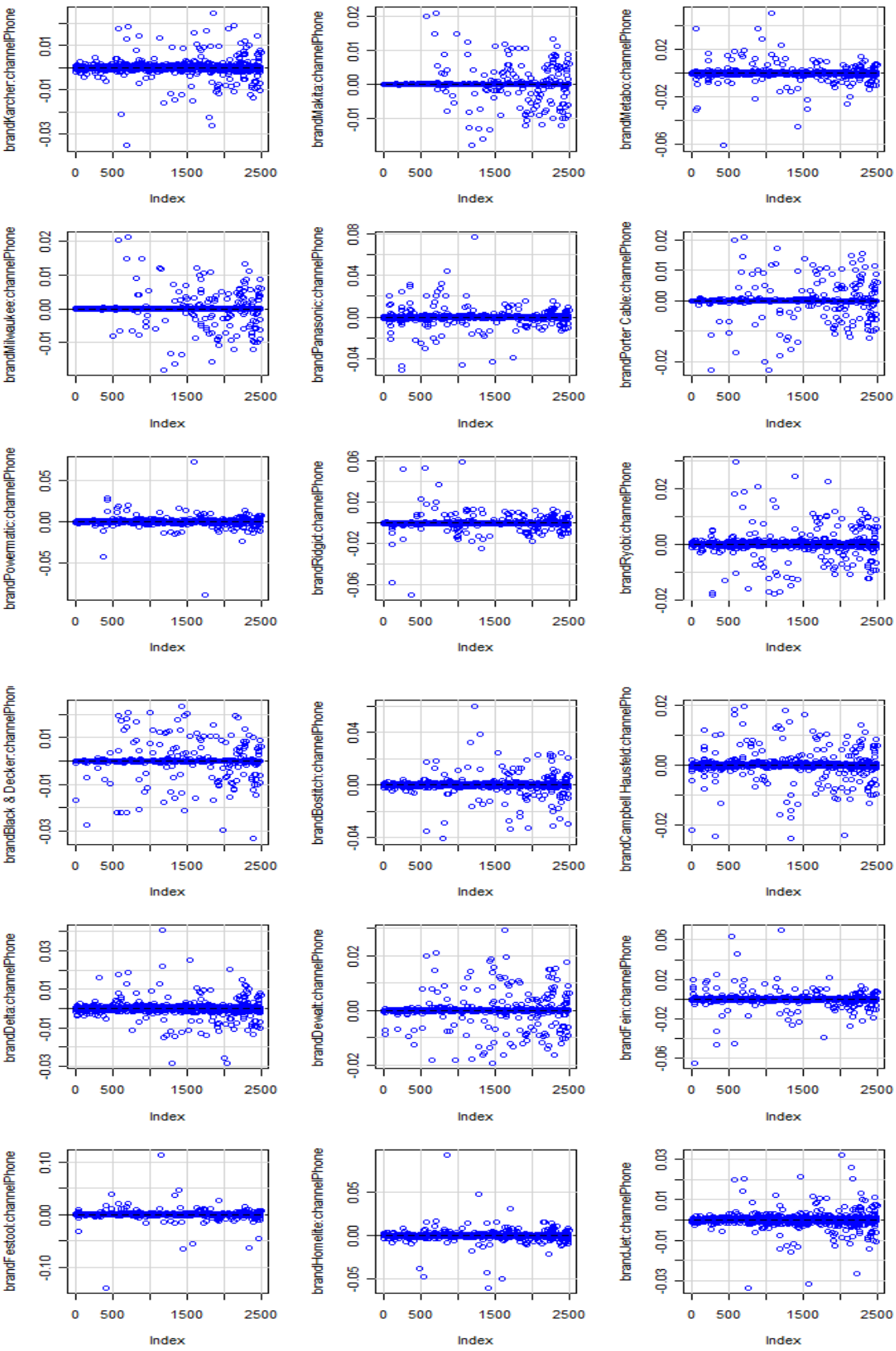
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brandPorter Cable:channelPhone
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brandRidgid:channelPhone
brandRyobi:channelPhone
brandBlack & Decker:channelPhon
brandBostitch:channelPhone
brandCampbell Hausfeld:channelPho
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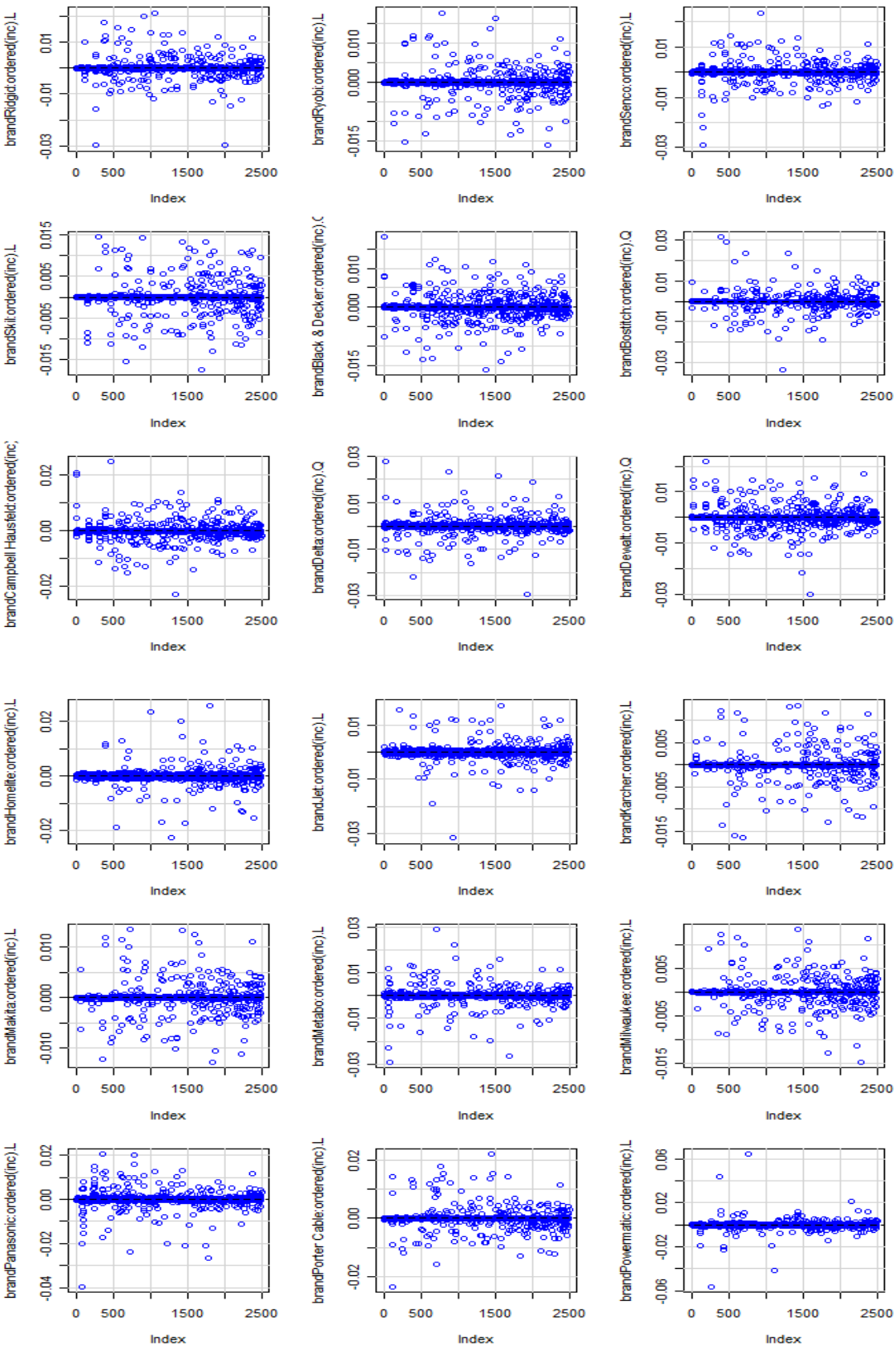
Index


brandRidgid:ordered(inc).L
brandRyobi:ordered(inc).L
brandSenco:ordered(inc).L
brandSkil:ordered(inc).L
brandBlack & Decker:ordered(inc).C
brandBostitch:ordered(inc).Q
brandCampbell Hausfeld:ordered(inc)
brandDelta:ordered(inc).Q
brandDewalt:ordered(inc).Q
brandHomelite:ordered(inc).L
brandJet:ordered(inc).L
brandKarcher:ordered(inc).L
brandMakita:ordered(inc).L
brandMetabo:ordered(inc).L
brandMilwaukee:ordered(inc).L
brandPanasonic:ordered(inc).L
brandPorter Cable:ordered(inc).L
brandPowermatic:ordered(inc).L
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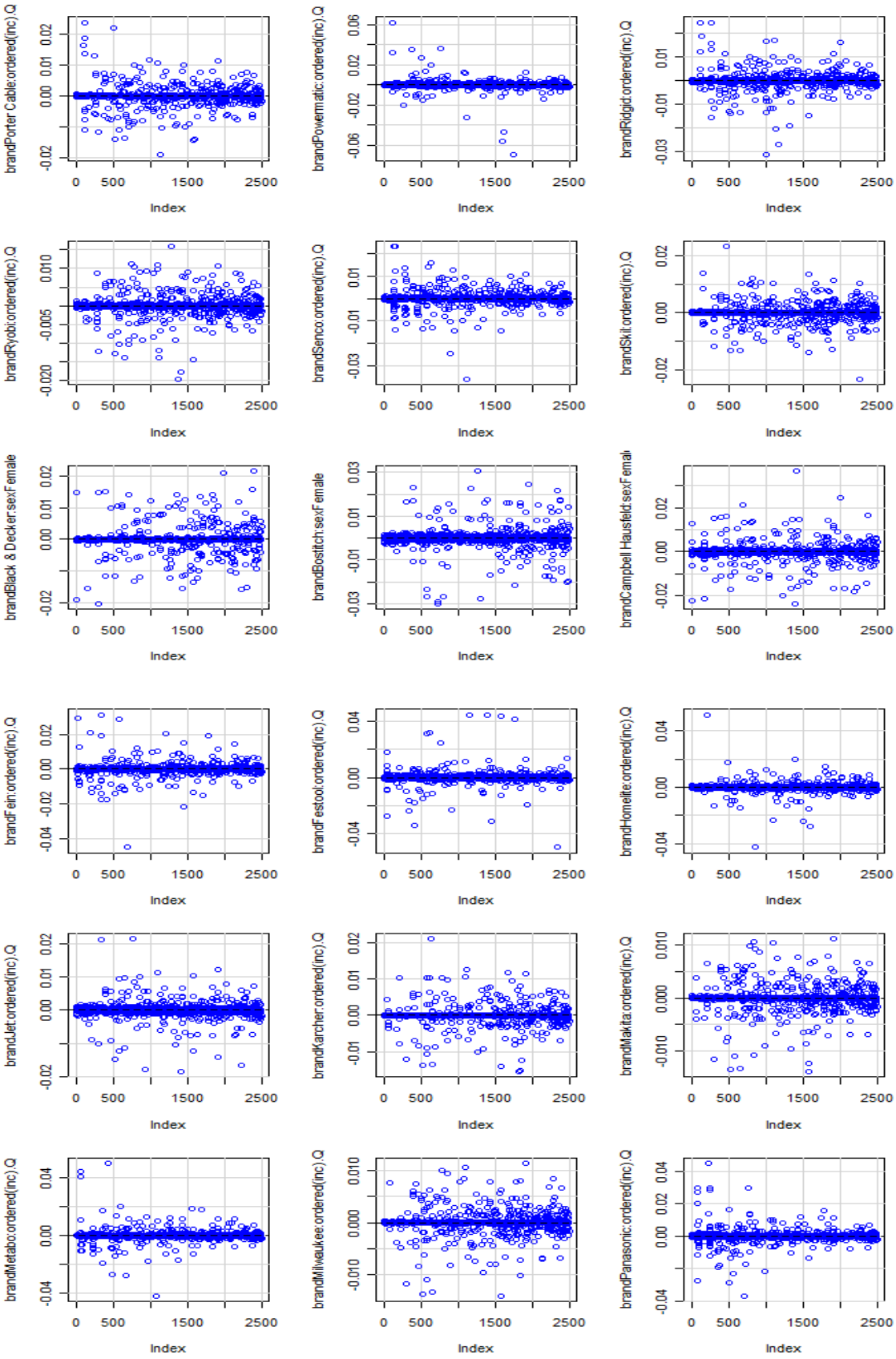
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brandRyobi:ordered(inc).Q
brandSenco:ordered(inc).Q
brandSkil:ordered(inc).Q
brandBlack & Decker:sexFemale
brandBostitch:sexFemale
brandCampbell Hausfeld:sexFemale
brandFein:ordered(inc).Q
brandFestool:ordered(inc).Q
brandHomelite:ordered(inc).Q
brandJet:ordered(inc).Q
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brandMilwaukee:ordered(inc).Q
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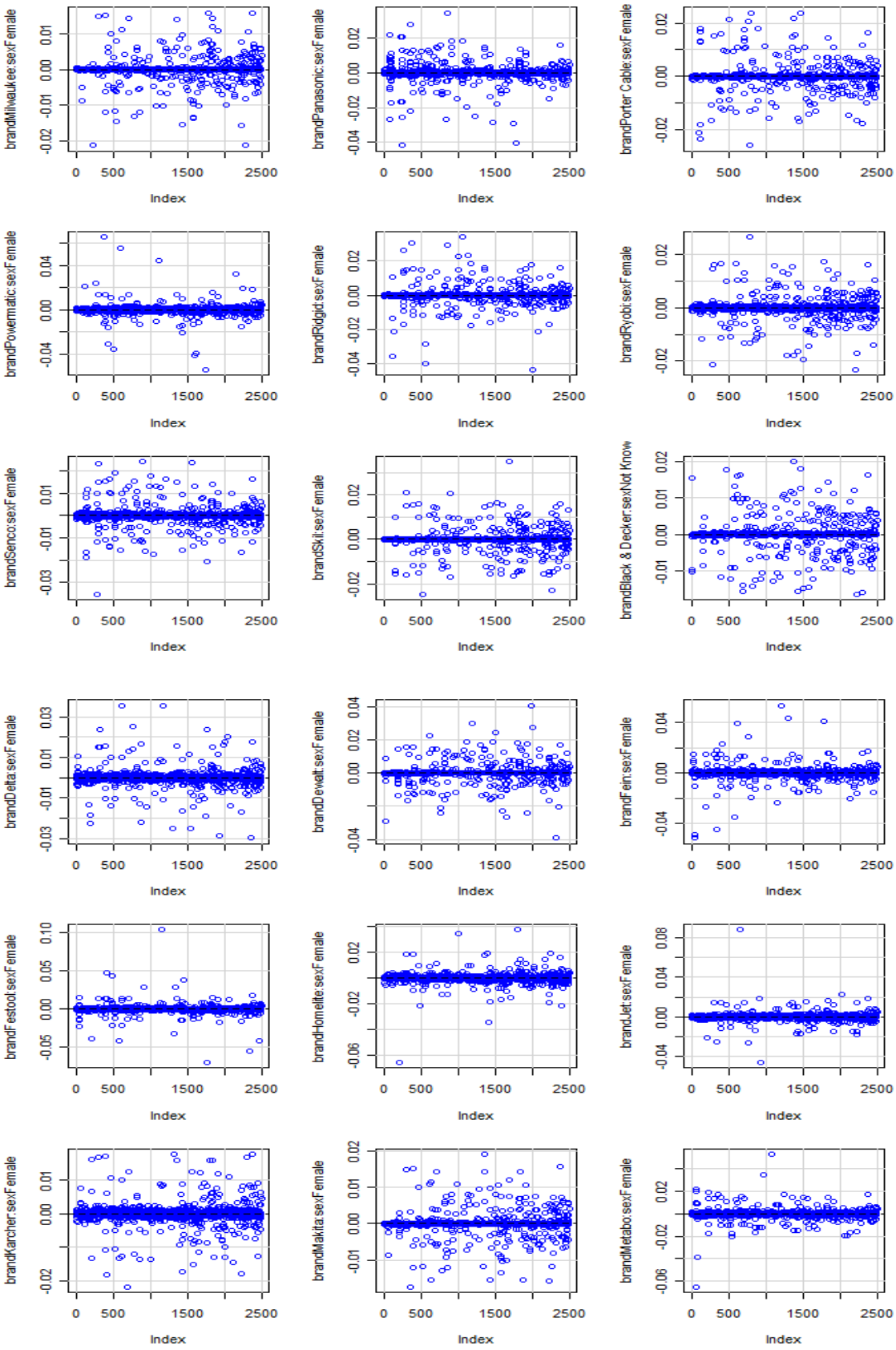
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brandPorter Cable:sexFemale
brandPowermatic:sexFemale
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brandRyobi:sexFemale
brandSenco:sexFemale
brandSkil:sexFemale
brandBlack & Decker:sexNot Know
brandDelta:sexFemale
brandDewalt:sexFemale
brandFein:sexFemale
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brandJet:sexFemale
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brandMakita:sexFemale
brandMetabo:sexFemale
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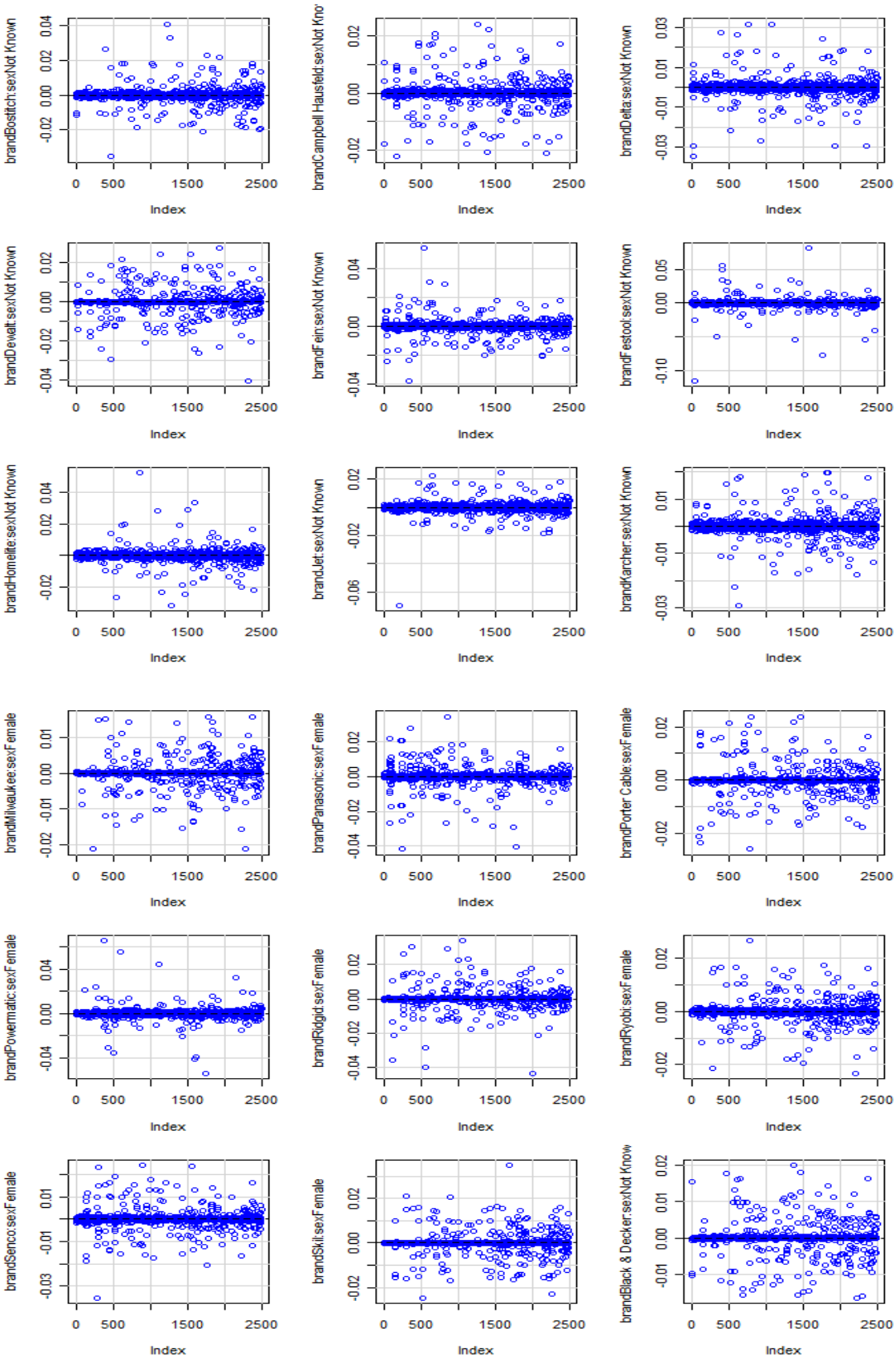
brandBostitch:sexNot Known
brandCampbell Hausfeld:sexNot Kno
brandDelta:sexNot Known
brandDewalt:sexNot Known
brandFein:sexNot Known
brandFestool:sexNot Known
brandHomelite:sexNot Known
brandJet:sexNot Known
brandKarcher:sexNot Known
brandMilwaukee:sexFemale
brandPanasonic:sexFemale
brandPorter Cable:sexFemale
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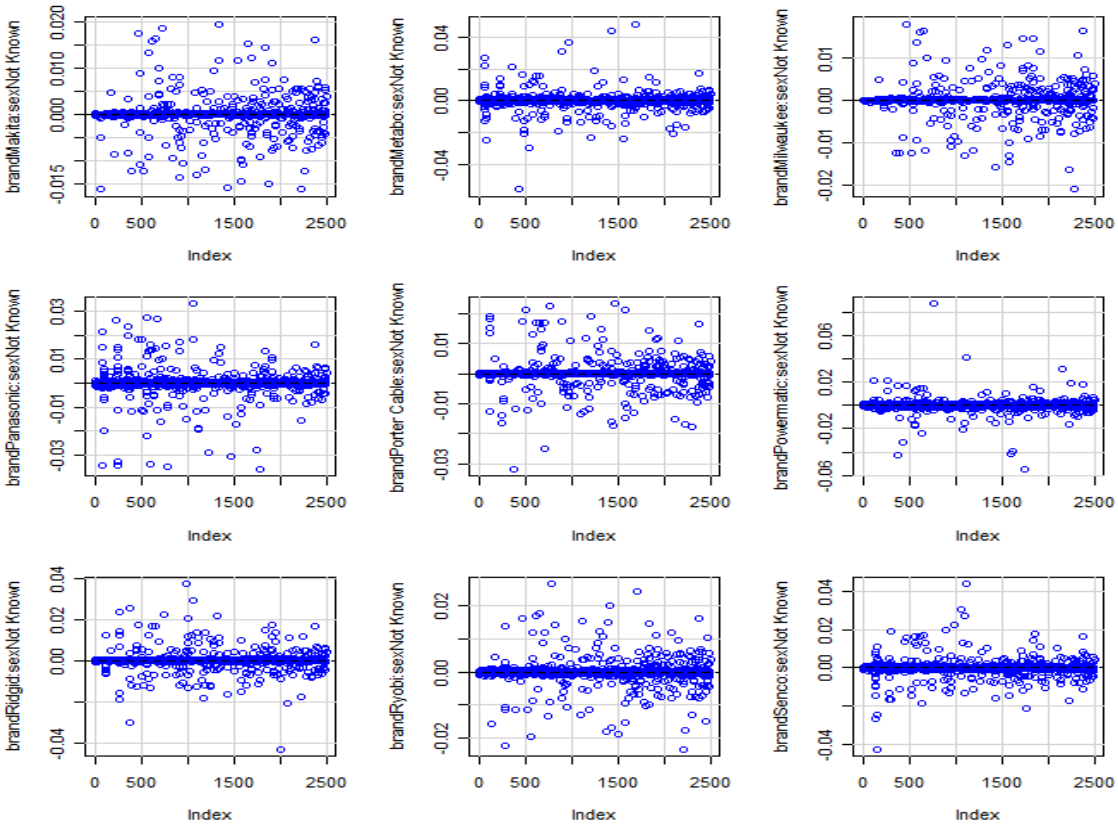
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brandMilwaukee:sexNot Known
brandPanasonic:sexNot Known
brandPorter Cable:sexNot Known
brandPowermatic:sexNot Known
brandRidgid:sexNot Known
brandRyobi:sexNot Known
brandSenco:sexNot Known
Index

Appendix 2

2-A: ANOVA Output

```
> anova(full_mod_nb_anova,full_mod_nbadd, test='Chisq');
Likelihood ratio tests of Negative Binomial Models

Response: freq
Model
1 brand + channel + sex + cordless + ordered(inc) + cond
2 brand:channel + brand:ordered(inc) + brand:sex + brand:cordless + brand:cond + channel:ordered(inc) + channel:sex + channel:cordless +
channel:cond + ordered(inc):sex + ordered(inc):cond + sex:cond + cordless:cond
         theta  Resid. df      2 x log-lik.     Test      df    LR stat.   Pr(Chi)
1 1.184505         2459      -25860.42
2 6.190681         2234      -22113.20    1 vs 2    225  3747.22             0

> anova(full_mod_nb_anova,full_mod_nbadd);
Likelihood ratio tests of Negative Binomial Models

Response: freq
Model
1 brand + channel + sex + cordless + ordered(inc) + cond
2 brand:channel + brand:ordered(inc) + brand:sex + brand:cordless + brand:cond + channel:ordered(inc) + channel:sex + channel:cordless +
channel:cond + ordered(inc):sex + ordered(inc):cond + sex:cond + cordless:cond
         theta   Resid. df      2 x log-lik.     Test      df    LR stat.   Pr(Chi)
1 1.184505         2459      -25860.42
2 6.190681         2234      -22113.20    1 vs 2    225  3747.22             0
```

2-B.1: Summary() Output `glm.nb`

```
> summary(full_mod_nb_sw)#, correlation=T);
Call:
glm.nb(formula = freq ~ brand:channel + brand:ordered(inc) + brand:sex + brand:cordless + brand:cond + channel:ordered(inc) + channel:sex +
channel:cordless + channel:cond + ordered(inc):sex +ordered(inc):cond + sex:cordless + sex:cond + cordless:cond, init.theta = 6.2085656, link =
log)
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-5.25918  -0.67050  -0.09786   0.50318   4.54447

Coefficients: (9 not defined because of singularities)
```

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	4.432857	0.107332	41.3	< 2e-16	***
brandBosch:channelBranded Web	2.635217	0.146345	18.007	< 2e-16	***
brandBlack & Decker:channelBranded Web	1.128783	0.148723	7.59	3.20E-14	***
brandBostitch:channelBranded Web	2.648012	0.166737	15.881	< 2e-16	***
brandCampbell Hausfeld:channelBranded Web	-0.677923	0.159605	-4.248	2.16E-05	***
brandDelta:channelBranded Web	3.205807	0.177074	18.104	< 2e-16	***
brandDewalt:channelBranded Web	2.208452	0.147958	14.926	< 2e-16	***
brandFein:channelBranded Web	-2.501873	0.241357	-10.366	< 2e-16	***
brandFestool:channelBranded Web	-1.454804	0.21209	-6.859	6.92E-12	***
brandHomelite:channelBranded Web	-3.753082	0.457301	-8.207	2.27E-16	***
brandJet:channelBranded Web	2.667954	0.19932	13.385	< 2e-16	***

brandKarcher:channelBranded Web	-2.305625	0.368168	-6.262	3.79E-10	***
brandMakita:channelBranded Web	2.093061	0.147577	14.183	< 2e-16	***
brandMetabo:channelBranded Web	-1.795951	0.212148	-8.466	< 2e-16	***
brandMilwaukee:channelBranded Web	2.922548	0.14676	19.914	< 2e-16	***
brandPanasonic:channelBranded Web	-0.381515	0.172934	-2.206	0.027375	*
brandPorter Cable:channelBranded Web	1.768873	0.149135	11.861	< 2e-16	***
brandPowermatic:channelBranded Web	0.696888	0.21437	3.251	0.001151	**
brandRidgid:channelBranded Web	0.5894	0.162354	3.63	0.000283	***
brandRyobi:channelBranded Web	-1.140508	0.186016	-6.131	8.72E-10	***
brandSenco:channelBranded Web	-1.882343	0.179182	-10.505	< 2e-16	***
brandSkil:channelBranded Web	1.729816	0.115214	15.014	< 2e-16	***
brandBosch:channelagg_channel	-0.6433	0.155363	-4.141	3.46E-05	***
brandBlack & Decker:channelagg_channel	-1.487047	0.176111	-8.444	< 2e-16	***
brandBostitch:channelagg_channel	-0.192839	0.196026	-0.984	0.325242	
brandCampbell Hausfeld:channelagg_channel	-3.835916	0.207256	-18.508	< 2e-16	***
brandDelta:channelagg_channel	-0.610659	0.223329	-2.734	0.00625	**
brandDewalt:channelagg_channel	-0.28455	0.154963	-1.836	0.066321	.
brandFein:channelagg_channel	-5.981976	0.318749	-18.767	< 2e-16	***
brandFestool:channelagg_channel	-4.860816	0.351205	-13.84	< 2e-16	***
brandHomelite:channelagg_channel	-5.795182	0.510909	-11.343	< 2e-16	***
brandJet:channelagg_channel	-1.220208	0.281044	-4.342	1.41E-05	***
brandKarcher:channelagg_channel	-4.754445	0.36069	-13.182	< 2e-16	***
brandMakita:channelagg_channel	-2.010895	0.165379	-12.159	< 2e-16	***
brandMetabo:channelagg_channel	-5.37193	0.308871	-17.392	< 2e-16	***
brandMilwaukee:channelagg_channel	-0.748139	0.1577	-4.744	2.09E-06	***
brandPanasonic:channelagg_channel	-3.11118	0.246434	-12.625	< 2e-16	***
brandPorter Cable:channelagg_channel	-1.304034	0.165159	-7.896	2.89E-15	***
brandPowermatic:channelagg_channel	-2.348149	0.361916	-6.488	8.69E-11	***
brandRidgid:channelagg_channel	-1.762354	0.170202	-10.354	< 2e-16	***
brandRyobi:channelagg_channel	-3.889189	0.205408	-18.934	< 2e-16	***
brandSenco:channelagg_channel	-4.728253	0.22744	-20.789	< 2e-16	***
brandSkil:channelagg_channel	-1.813097	0.136394	-13.293	< 2e-16	***
brandBosch:channelAmazon Sales	0.563851	0.147886	3.813	0.000137	***
brandBlack & Decker:channelAmazon Sales	0.364217	0.149598	2.435	0.014907	*
brandBostitch:channelAmazon Sales	0.753706	0.179537	4.198	2.69E-05	***
brandCampbell Hausfeld:channelAmazon Sales	-2.623263	0.173423	-15.126	< 2e-16	***
brandDelta:channelAmazon Sales	0.993417	0.189456	5.244	1.58E-07	***
brandDewalt:channelAmazon Sales	-0.286929	0.151174	-1.898	0.057695	.
brandFein:channelAmazon Sales	-4.294798	0.278041	-15.447	< 2e-16	***
brandFestool:channelAmazon Sales	-3.804347	0.245885	-15.472	< 2e-16	***
brandHomelite:channelAmazon Sales	-5.474585	0.505028	-10.84	< 2e-16	***
brandJet:channelAmazon Sales	1.373987	0.21011	6.539	6.18E-11	***
brandKarcher:channelAmazon Sales	-3.816569	0.351462	-10.859	< 2e-16	***

brandMakita:channelAmazon Sales	-0.347506	0.150408	-2.31	0.020865	*
brandMetabo:channelAmazon Sales	-3.986796	0.238494	-16.717	< 2e-16	***
brandMilwaukee:channelAmazon Sales	0.863782	0.148198	5.829	5.59E-09	***
brandPanasonic:channelAmazon Sales	-1.363336	0.177231	-7.692	1.44E-14	***
brandPorter Cable:channelAmazon Sales	-0.957463	0.154248	-6.207	5.39E-10	***
brandPowermatic:channelAmazon Sales	0.413238	0.223056	1.853	0.063937	.
brandRidgid:channelAmazon Sales	-1.245704	0.161492	-7.714	1.22E-14	***
brandRyobi:channelAmazon Sales	-2.545099	0.187694	-13.56	< 2e-16	***
brandSenco:channelAmazon Sales	-3.41259	0.186328	-18.315	< 2e-16	***
brandSkil:channelAmazon Sales	-0.451212	0.117916	-3.827	0.00013	***
brandBosch:channeleBay Sales	-1.246932	0.15442	-8.075	6.75E-16	***
brandBlack & Decker:channeleBay Sales	-0.906397	0.154117	-5.881	4.07E-09	***
brandBostitch:channeleBay Sales	-0.692648	0.188835	-3.668	0.000244	***
brandCampbell Hausfeld:channeleBay Sales	-3.750642	0.187925	-19.958	< 2e-16	***
brandDelta:channeleBay Sales	-2.6861	0.294242	-9.129	< 2e-16	***
brandDewalt:channeleBay Sales	-1.355404	0.160849	-8.427	< 2e-16	***
brandFein:channeleBay Sales	-4.92317	0.283299	-17.378	< 2e-16	***
brandFestool:channeleBay Sales	-6.737029	0.371196	-18.15	< 2e-16	***
brandHomelite:channeleBay Sales	-5.643465	0.506868	-11.134	< 2e-16	***
brandJet:channeleBay Sales	0.574438	0.21659	2.652	0.007997	**
brandKarcher:channeleBay Sales	-5.166433	0.365895	-14.12	< 2e-16	***
brandMakita:channeleBay Sales	-1.452581	0.156272	-9.295	< 2e-16	***
brandMetabo:channeleBay Sales	-4.773583	0.255543	-18.68	< 2e-16	***
brandMilwaukee:channeleBay Sales	-0.148771	0.151928	-0.979	0.327472	
brandPanasonic:channeleBay Sales	-3.014063	0.213874	-14.093	< 2e-16	***
brandPorter Cable:channeleBay Sales	-2.485056	0.176037	-14.117	< 2e-16	***
brandPowermatic:channeleBay Sales	-2.096023	0.28625	-7.322	2.44E-13	***
brandRidgid:channeleBay Sales	-1.753887	0.179766	-9.756	< 2e-16	***
brandRyobi:channeleBay Sales	-3.305267	0.192492	-17.171	< 2e-16	***
brandSenco:channeleBay Sales	-4.608021	0.207173	-22.242	< 2e-16	***
brandSkil:channeleBay Sales	-1.56206	0.124198	-12.577	< 2e-16	***
brandBosch:channelPhone	1.303975	0.135496	9.624	< 2e-16	***
brandBlack & Decker:channelPhone	-0.798262	0.142367	-5.607	2.06E-08	***
brandBostitch:channelPhone	1.215974	0.166951	7.283	3.25E-13	***
brandCampbell Hausfeld:channelPhone	-2.383234	0.161796	-14.73	< 2e-16	***
brandDelta:channelPhone	2.188218	0.176555	12.394	< 2e-16	***
brandDewalt:channelPhone	0.350946	0.139786	2.511	0.012053	*
brandFein:channelPhone	-4.161368	0.259255	-16.051	< 2e-16	***
brandFestool:channelPhone	-2.75095	0.239048	-11.508	< 2e-16	***
brandHomelite:channelPhone	-5.496725	0.504083	-10.904	< 2e-16	***
brandJet:channelPhone	1.753505	0.201914	8.684	< 2e-16	***
brandKarcher:channelPhone	-4.001815	0.365138	-10.96	< 2e-16	***
brandMakita:channelPhone	0.698385	0.137364	5.084	3.69E-07	***

brandMetabo:channelPhone	-2.695586	0.216441	-12.454	< 2e-16	***
brandMilwaukee:channelPhone	1.407792	0.136345	10.325	< 2e-16	***
brandPanasonic:channelPhone	-1.685697	0.182293	-9.247	< 2e-16	***
brandPorter Cable:channelPhone	0.35442	0.139817	2.535	0.011248	*
brandPowermatic:channelPhone	0.55012	0.216683	2.539	0.011123	*
brandRidgid:channelPhone	-1.171874	0.159793	-7.334	2.24E-13	***
brandRyobi:channelPhone	-3.25351	0.184479	-17.636	< 2e-16	***
brandSenco:channelPhone	-3.050432	0.178816	-17.059	< 2e-16	***
brandSkil:channelPhone	NA	NA	NA	NA	
brandBosch:ordered(inc).L	-1.673347	0.067731	-24.706	< 2e-16	***
brandBlack & Decker:ordered(inc).L	-1.618651	0.070181	-23.064	< 2e-16	***
brandBostitch:ordered(inc).L	-1.589937	0.088102	-18.047	< 2e-16	***
brandCampbell Hausfeld:ordered(inc).L	-1.52363	0.079402	-19.189	< 2e-16	***
brandDelta:ordered(inc).L	-1.537384	0.104257	-14.746	< 2e-16	***
brandDewalt:ordered(inc).L	-1.596259	0.069525	-22.96	< 2e-16	***
brandFein:ordered(inc).L	-1.703894	0.103801	-16.415	< 2e-16	***
brandFestool:ordered(inc).L	-1.708904	0.134159	-12.738	< 2e-16	***
brandHomelite:ordered(inc).L	-1.545327	0.118253	-13.068	< 2e-16	***
brandJet:ordered(inc).L	-1.573776	0.121549	-12.948	< 2e-16	***
brandKarcher:ordered(inc).L	-1.782999	0.088765	-20.087	< 2e-16	***
brandMakita:ordered(inc).L	-1.606217	0.069339	-23.165	< 2e-16	***
brandMetabo:ordered(inc).L	-1.401723	0.104498	-13.414	< 2e-16	***
brandMilwaukee:ordered(inc).L	-1.622123	0.067958	-23.869	< 2e-16	***
brandPanasonic:ordered(inc).L	-1.542533	0.109488	-14.089	< 2e-16	***
brandPorter Cable:ordered(inc).L	-1.560781	0.071434	-21.849	< 2e-16	***
brandPowermatic:ordered(inc).L	-1.833636	0.147662	-12.418	< 2e-16	***
brandRidgid:ordered(inc).L	-1.608955	0.076149	-21.129	< 2e-16	***
brandRyobi:ordered(inc).L	-1.606569	0.078156	-20.556	< 2e-16	***
brandSenco:ordered(inc).L	-1.585782	0.086696	-18.291	< 2e-16	***
brandSkil:ordered(inc).L	-1.541812	0.0688	-22.41	< 2e-16	***
brandBosch:ordered(inc).Q	0.740878	0.069922	10.596	< 2e-16	***
brandBlack & Decker:ordered(inc).Q	0.648063	0.072842	8.897	< 2e-16	***
brandBostitch:ordered(inc).Q	0.869481	0.091829	9.468	< 2e-16	***
brandCampbell Hausfeld:ordered(inc).Q	0.722781	0.083662	8.639	< 2e-16	***
brandDelta:ordered(inc).Q	0.825013	0.109594	7.528	5.16E-14	***
brandDewalt:ordered(inc).Q	1.021213	0.073997	13.801	< 2e-16	***
brandFein:ordered(inc).Q	0.596464	0.108313	5.507	3.65E-08	***
brandFestool:ordered(inc).Q	0.430225	0.130448	3.298	0.000974	***
brandHomelite:ordered(inc).Q	0.772256	0.121452	6.359	2.04E-10	***
brandJet:ordered(inc).Q	1.00886	0.127772	7.896	2.88E-15	***
brandKarcher:ordered(inc).Q	0.373376	0.090158	4.141	3.45E-05	***
brandMakita:ordered(inc).Q	0.821378	0.072009	11.407	< 2e-16	***
brandMetabo:ordered(inc).Q	0.839865	0.111621	7.524	5.30E-14	***

brandMilwaukee:ordered(inc).Q	1.000424	0.070868	14.117	< 2e-16	***
brandPanasonic:ordered(inc).Q	0.722226	0.117768	6.133	8.65E-10	***
brandPorter Cable:ordered(inc).Q	0.855129	0.074559	11.469	< 2e-16	***
brandPowermatic:ordered(inc).Q	0.864948	0.158501	5.457	4.84E-08	***
brandRidgid:ordered(inc).Q	0.870583	0.083485	10.428	< 2e-16	***
brandRyobi:ordered(inc).Q	0.736987	0.0821	8.977	< 2e-16	***
brandSenco:ordered(inc).Q	1.00953	0.096044	10.511	< 2e-16	***
brandSkil:ordered(inc).Q	0.880167	0.072314	12.171	< 2e-16	***
brandBosch:sexFemale	-1.718678	0.094903	-18.11	< 2e-16	***
brandBlack & Decker:sexFemale	-0.725286	0.097282	-7.455	8.95E-14	***
brandBostitch:sexFemale	-1.483729	0.132222	-11.222	< 2e-16	***
brandCampbell Hausfeld:sexFemale	-1.325482	0.113983	-11.629	< 2e-16	***
brandDelta:sexFemale	-1.906898	0.153194	-12.448	< 2e-16	***
brandDewalt:sexFemale	-1.586499	0.098245	-16.148	< 2e-16	***
brandFein:sexFemale	-1.353213	0.14797	-9.145	< 2e-16	***
brandFestool:sexFemale	-2.031775	0.182081	-11.159	< 2e-16	***
brandHomelite:sexFemale	-1.383606	0.173193	-7.989	1.36E-15	***
brandJet:sexFemale	-2.094242	0.179719	-11.653	< 2e-16	***
brandKarcher:sexFemale	-1.265349	0.130176	-9.72	< 2e-16	***
brandMakita:sexFemale	-1.552349	0.097601	-15.905	< 2e-16	***
brandMetabo:sexFemale	-1.754253	0.153376	-11.438	< 2e-16	***
brandMilwaukee:sexFemale	-1.784357	0.095417	-18.701	< 2e-16	***
brandPanasonic:sexFemale	-1.779795	0.151046	-11.783	< 2e-16	***
brandPorter Cable:sexFemale	-1.592111	0.101385	-15.704	< 2e-16	***
brandPowermatic:sexFemale	-2.54397	0.219208	-11.605	< 2e-16	***
brandRidgid:sexFemale	-1.725779	0.109546	-15.754	< 2e-16	***
brandRyobi:sexFemale	-1.350784	0.11233	-12.025	< 2e-16	***
brandSenco:sexFemale	-1.694791	0.126703	-13.376	< 2e-16	***
brandSkil:sexFemale	-1.148296	0.096478	-11.902	< 2e-16	***
brandBosch:sexNot Known	-1.954637	0.094711	-20.638	< 2e-16	***
brandBlack & Decker:sexNot Known	-1.756109	0.099595	-17.632	< 2e-16	***
brandBostitch:sexNot Known	-1.961321	0.131862	-14.874	< 2e-16	***
brandCampbell Hausfeld:sexNot Known	-1.960952	0.11756	-16.68	< 2e-16	***
brandDelta:sexNot Known	-2.168091	0.153357	-14.138	< 2e-16	***
brandDewalt:sexNot Known	-2.042052	0.098971	-20.633	< 2e-16	***
brandFein:sexNot Known	-1.959306	0.151473	-12.935	< 2e-16	***
brandFestool:sexNot Known	-1.862089	0.178033	-10.459	< 2e-16	***
brandHomelite:sexNot Known	-2.007114	0.172334	-11.647	< 2e-16	***
brandJet:sexNot Known	-2.093695	0.177998	-11.762	< 2e-16	***
brandKarcher:sexNot Known	-1.900955	0.132457	-14.351	< 2e-16	***
brandMakita:sexNot Known	-1.859378	0.097515	-19.068	< 2e-16	***
brandMetabo:sexNot Known	-1.781285	0.146199	-12.184	< 2e-16	***
brandMilwaukee:sexNot Known	-2.130642	0.095391	-22.336	< 2e-16	***

brandPanasonic:sexNot Known	-1.695425	0.144687	-11.718	< 2e-16	***
brandPorter Cable:sexNot Known	-2.176909	0.101421	-21.464	< 2e-16	***
brandPowermatic:sexNot Known	-2.394182	0.212211	-11.282	< 2e-16	***
brandRidgid:sexNot Known	-2.109243	0.110705	-19.053	< 2e-16	***
brandRyobi:sexNot Known	-1.923301	0.113517	-16.943	< 2e-16	***
brandSenco:sexNot Known	-2.114309	0.129541	-16.322	< 2e-16	***
brandSkil:sexNot Known	-2.054337	0.098765	-20.8	< 2e-16	***
brandBosch:cordlessNot Cordless	2.051494	0.083252	24.642	< 2e-16	***
brandBlack & Decker:cordlessNot Cordless	0.665125	0.086184	7.718	1.19E-14	***
brandBostitch:cordlessNot Cordless	NA	NA	NA	NA	
brandCampbell Hausfeld:cordlessNot Cordless	3.616180	0.109958	32.887	< 2e-16	***
brandDelta:cordlessNot Cordless	NA	NA	NA	NA	
brandDewalt:cordlessNot Cordless	1.041433	0.085541	12.175	< 2e-16	***
brandFein:cordlessNot Cordless	4.723497	0.225385	20.957	< 2e-16	***
brandFestool:cordlessNot Cordless	3.887669	0.190103	20.45	< 2e-16	***
brandHomelite:cordlessNot Cordless	NA	NA	NA	NA	
brandJet:cordlessNot Cordless	NA	NA	NA	NA	
brandKarcher:cordlessNot Cordless	4.820485	0.344299	14.001	< 2e-16	***
brandMakita:cordlessNot Cordless	1.522998	0.08492	17.934	< 2e-16	***
brandMetabo:cordlessNot Cordless	3.793197	0.184512	20.558	< 2e-16	***
brandMilwaukee:cordlessNot Cordless	0.816621	0.083539	9.775	< 2e-16	***
brandPanasonic:cordlessNot Cordless	-0.309751	0.119953	-2.582	0.009815	**
brandPorter Cable:cordlessNot Cordless	1.926449	0.087813	21.938	< 2e-16	***
brandPowermatic:cordlessNot Cordless	NA	NA	NA	NA	
brandRidgid:cordlessNot Cordless	0.898367	0.096813	9.279	< 2e-16	***
brandRyobi:cordlessNot Cordless	3.09552	0.113675	27.231	< 2e-16	***
brandSenco:cordlessNot Cordless	2.928078	0.119731	24.455	< 2e-16	***
brandSkil:cordlessNot Cordless	2.115117	0.08522	24.82	< 2e-16	***
brandBosch:condReconditioned	0.139801	0.08107	1.724	0.084627	.
brandBlack & Decker:condReconditioned	0.471074	0.084605	5.568	2.58E-08	***
brandBostitch:condReconditioned	1.069913	0.111498	9.596	< 2e-16	***
brandCampbell Hausfeld:condReconditioned	-0.155216	0.096793	-1.604	0.108804	
brandDelta:condReconditioned	-1.88717	0.129985	-14.518	< 2e-16	***
brandDewalt:condReconditioned	-0.485644	0.083756	-5.798	6.70E-09	***
brandFein:condReconditioned	-1.838577	0.142652	-12.889	< 2e-16	***
brandFestool:condReconditioned	NA	NA	NA	NA	
brandHomelite:condReconditioned	6.838807	0.472256	14.481	< 2e-16	***
brandJet:condReconditioned	NA	NA	NA	NA	
brandKarcher:condReconditioned	0.573701	0.111233	5.158	2.50E-07	***
brandMakita:condReconditioned	0.353973	0.082873	4.271	1.94E-05	***
brandMetabo:condReconditioned	-1.880562	0.14054	-13.381	< 2e-16	***
brandMilwaukee:condReconditioned	-0.071068	0.081315	-0.874	0.38213	
brandPanasonic:condReconditioned	-1.173486	0.12152	-9.657	< 2e-16	***

brandPorter Cable:condReconditioned	0.15128	0.086433	1.75	0.080074	.
brandPowermatic:condReconditioned	NA	NA	NA	NA	
brandRidgid:condReconditioned	0.774195	0.096189	8.049	8.37E-16	***
brandRyobi:condReconditioned	2.226436	0.112645	19.765	< 2e-16	***
brandSenco:condReconditioned	0.893921	0.10874	8.221	< 2e-16	***
brandSkil:condReconditioned	0.370373	0.083126	4.456	8.37E-06	***
channelagg_channel:ordered(inc).L	0.092042	0.053886	1.708	0.087621	.
channelAmazon Sales:ordered(inc).L	-0.017592	0.046146	-0.381	0.703036	
channeleBay Sales:ordered(inc).L	0.129572	0.049244	2.631	0.008507	**
channelPhone:ordered(inc).L	0.106279	0.046907	2.266	0.023467	*
channelagg_channel:ordered(inc).Q	-0.053706	0.058195	-0.923	0.35608	
channelAmazon Sales:ordered(inc).Q	-0.19494	0.047193	-4.131	3.62E-05	***
channeleBay Sales:ordered(inc).Q	0.396009	0.053313	7.428	1.10E-13	***
channelPhone:ordered(inc).Q	0.146218	0.049367	2.962	0.003058	**
channelagg_channel:sexFemale	-0.556835	0.07842	-7.101	1.24E-12	***
channelAmazon Sales:sexFemale	0.56166	0.064658	8.687	< 2e-16	***
channeleBay Sales:sexFemale	0.194313	0.070406	2.76	0.005782	**
channelPhone:sexFemale	-0.038555	0.066267	-0.582	0.560692	
channelagg_channel:sexNot Known	0.022173	0.075966	0.292	0.77038	
channelAmazon Sales:sexNot Known	0.509403	0.065217	7.811	5.68E-15	***
channeleBay Sales:sexNot Known	0.434667	0.070499	6.166	7.02E-10	***
channelPhone:sexNot Known	-0.055844	0.067189	-0.831	0.405888	
channelagg_channel:cordlessNot Cordless	-0.616327	0.072686	-8.479	< 2e-16	***
channelAmazon Sales:cordlessNot Cordless	-0.061276	0.061071	-1.003	0.31569	
channeleBay Sales:cordlessNot Cordless	-0.021747	0.067328	-0.323	0.74669	
channelPhone:cordlessNot Cordless	0.007024	0.063188	0.111	0.911483	
channelagg_channel:condReconditioned	1.410816	0.067245	20.98	< 2e-16	***
channelAmazon Sales:condReconditioned	0.945815	0.056689	16.684	< 2e-16	***
channeleBay Sales:condReconditioned	1.547992	0.061736	25.075	< 2e-16	***
channelPhone:condReconditioned	-0.183443	0.057905	-3.168	0.001535	**
ordered(inc).L:sexFemale	0.169094	0.038132	4.434	9.23E-06	***
ordered(inc).Q:sexFemale	0.20811	0.041151	5.057	4.25E-07	***
ordered(inc).L:sexNot Known	0.074604	0.038732	1.926	0.054087	.
ordered(inc).Q:sexNot Known	-0.040523	0.040553	-0.999	0.317672	
ordered(inc).L:condReconditioned	-0.015196	0.033502	-0.454	0.650136	
ordered(inc).Q:condReconditioned	0.121143	0.0357	3.393	0.00069	***
sexFemale:cordlessNot Cordless	-0.148618	0.051521	-2.885	0.003919	**
sexNot Known:cordlessNot Cordless	-0.097872	0.05199	-1.882	0.059769	.
sexFemale:condReconditioned	-0.48961	0.047601	-10.286	< 2e-16	***
sexNot Known:condReconditioned	-0.104432	0.047772	-2.186	0.028812	*
cordlessNot Cordless:condReconditioned	-0.472848	0.045883	-10.305	< 2e-16	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for Negative Binomial(6.2086) family taken to be 1)

Null deviance: 60476.3 on 2489 degrees of freedom
Residual deviance: 2652.8 on 2232 degrees of freedom
AIC: 22622

Number of Fisher Scoring iterations: 1

Theta: 6.209
Std. Err.: 0.227
2 x log-likelihood: -22104.437

2-B.2: Summary() Output `glm.poisson.disp`

> summary(full_mod_disp_sw);

Call:
glm(formula = freq ~ brand * channel + brand * ordered(inc) + brand * sex + brand * cordless + brand * cond + channel * ordered(inc) + channel * sex + channel * cordless + channel * cond + ordered(inc) * sex + ordered(inc) * cond + sex * cordless + sex * cond + cordless * cond, family = poisson(), weights = disp.weights)

Deviance Residuals:
Min 1Q Median 3Q Max
-2.98942 -0.61366 -0.08906 0.48620 5.25353

Coefficients: (8 not defined because of singularities)

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	7.06601	0.108821	64.933	< 2e-16	***
brandBlack & Decker	-1.510262	0.143954	-10.491	< 2e-16	***
brandBostitch	-2.040964	0.167863	-12.159	< 2e-16	***
brandCampbell Hausfeld	-3.31416	0.155908	-21.257	< 2e-16	***
brandDelta	-1.48437	0.180155	-8.239	< 2e-16	***
brandDewalt	-0.423087	0.142839	-2.962	0.003057	**
brandFein	-5.121874	0.244066	-20.986	< 2e-16	***
brandFestool	-4.081417	0.215702	-18.922	< 2e-16	***
brandHomelite	-8.440599	0.472688	-17.857	< 2e-16	***
brandJet	-2.018884	0.207304	-9.739	< 2e-16	***
brandKarcher	-4.912438	0.371099	-13.238	< 2e-16	***
brandMakita	-0.541428	0.141925	-3.815	1.36E-04	***
brandMetabo	-4.42125	0.212003	-20.855	< 2e-16	***
brandMilwaukee	0.285945	0.141155	2.026	0.042791	*
brandPanasonic	-3.018758	0.173461	-17.403	< 2e-16	***
brandPorter Cable	-0.865996	0.143786	-6.023	1.71E-09	***
brandPowermatic	-3.997	0.22328	-17.901	< 2e-16	***
brandRidgid	-2.039047	0.159401	-12.792	< 2e-16	***
brandRyobi	-3.776981	0.185432	-20.369	< 2e-16	***
brandSenco	-4.517897	0.177089	-25.512	< 2e-16	***
brandSkil	-0.905449	0.142004	-6.376	1.81E-10	***
channelagg_channel	-3.275956	0.131051	-24.997	< 2e-16	***

channelAmazon Sales	-2.066272	0.120034	-17.214	< 2e-16	***
channeleBay Sales	-3.87458	0.127846	-30.307	< 2e-16	***
channelPhone	-1.33148	0.121011	-11.003	< 2e-16	***
ordered(inc).L	-1.672958	0.072691	-23.015	< 2e-16	***
ordered(inc).Q	0.739884	0.074868	9.883	< 2e-16	***
sexFemale	-1.715985	0.10175	-16.865	< 2e-16	***
sexNot Known	-1.951399	0.101541	-19.218	< 2e-16	***
cordlessNot Cordless	2.053839	0.089228	23.018	< 2e-16	***
condReconditioned	0.139555	0.08692	1.606	0.108374	
brandBlack & Decker:channelagg_channel	0.654681	0.169091	3.872	1.08E-04	***
brandBostitch:channelagg_channel	0.43093	0.199845	2.156	0.031058	*
brandCampbell Hausfeld:channelagg_channel	0.116411	0.193528	0.602	0.547492	
brandDelta:channelagg_channel	-0.529681	0.240943	-2.198	0.027923	*
brandDewalt:channelagg_channel	0.779317	0.157859	4.937	7.94E-07	***
brandFein:channelagg_channel	-0.180077	0.253542	-0.71	0.477553	
brandFestool:channelagg_channel	-0.130023	0.334922	-0.388	6.98E-01	
brandHomelite:channelagg_channel	1.233865	0.246013	5.015	5.29E-07	***
brandJet:channelagg_channel	-0.600652	0.325004	-1.848	0.064582	.
brandKarcher:channelagg_channel	0.831426	0.197502	4.21	2.56E-05	***
brandMakita:channelagg_channel	-0.831012	0.166272	-4.998	5.80E-07	***
brandMetabo:channelagg_channel	-0.294359	0.280145	-1.051	0.293379	
brandMilwaukee:channelagg_channel	-0.392924	0.161027	-2.44	0.014683	*
brandPanasonic:channelagg_channel	0.563648	0.263485	2.139	0.032419	*
brandPorter Cable:channelagg_channel	0.200587	0.162397	1.235	2.17E-01	
brandPowermatic:channelagg_channel	0.230159	0.415434	0.554	0.579565	
brandRidgid:channelagg_channel	0.927331	0.171251	5.415	6.13E-08	***
brandRyobi:channelagg_channel	0.517785	0.177031	2.925	0.003446	**
brandSenco:channelagg_channel	0.433431	0.209048	2.073	0.038139	*
brandSkil:channelagg_channel	-0.272198	0.164201	-1.658	0.097375	.
brandBlack & Decker:channelAmazon Sales	1.307686	0.148009	8.835	< 2e-16	***
brandBostitch:channelAmazon Sales	0.175789	0.183835	0.956	3.39E-01	
brandCampbell Hausfeld:channelAmazon Sales	0.13058	0.163239	0.8	0.423753	
brandDelta:channelAmazon Sales	-0.144563	0.192543	-0.751	0.452767	
brandDewalt:channelAmazon Sales	-0.427042	0.150462	-2.838	0.004537	**
brandFein:channelAmazon Sales	0.286643	0.218446	1.312	1.89E-01	
brandFestool:channelAmazon Sales	-0.257461	0.221821	-1.161	2.46E-01	
brandHomelite:channelAmazon Sales	0.355377	0.237682	1.495	1.35E-01	
brandJet:channelAmazon Sales	0.776573	0.239188	3.247	0.001167	**
brandKarcher:channelAmazon Sales	0.560474	0.182843	3.065	2.17E-03	**
brandMakita:channelAmazon Sales	-0.370133	0.148511	-2.492	0.012692	*
brandMetabo:channelAmazon Sales	-0.116221	0.198642	-0.585	0.558495	
brandMilwaukee:channelAmazon Sales	0.012901	0.147632	0.087	0.930366	
brandPanasonic:channelAmazon Sales	1.082187	0.17894	6.048	1.47E-09	***

brandPorter Cable:channelAmazon Sales	-0.653628	0.151176	-4.324	1.53E-05	***
brandPowermatic:channelAmazon Sales	1.794149	0.259974	6.901	5.15E-12	***
brandRidgid:channelAmazon Sales	0.233405	0.158374	1.474	0.140546	
brandRyobi:channelAmazon Sales	0.666398	0.16151	4.126	3.69E-05	***
brandSenco:channelAmazon Sales	0.542687	0.169753	3.197	0.001389	**
brandSkil:channelAmazon Sales	-0.110959	0.148386	-0.748	0.454595	
brandBlack & Decker:channeleBay Sales	1.841663	0.15379	11.975	< 2e-16	***
brandBostitch:channeleBay Sales	0.536528	0.192448	2.788	0.005305	**
brandCampbell Hausfeld:channeleBay Sales	0.801435	0.173418	4.621	3.81E-06	***
brandDelta:channeleBay Sales	-1.982532	0.311473	-6.365	1.95E-10	***
brandDewalt:channeleBay Sales	0.313123	0.162024	1.933	0.053288	.
brandFein:channeleBay Sales	1.462071	0.201752	7.247	4.27E-13	***
brandFestool:channeleBay Sales	-1.390297	0.355223	-3.914	9.08E-05	***
brandHomelite:channeleBay Sales	1.990953	0.240056	8.294	< 2e-16	***
brandJet:channeleBay Sales	1.781779	0.248015	7.184	6.76E-13	***
brandKarcher:channeleBay Sales	1.016796	0.190093	5.349	8.85E-08	***
brandMakita:channeleBay Sales	0.335806	0.155209	2.164	0.030497	*
brandMetabo:channeleBay Sales	0.912767	0.215846	4.229	2.35E-05	***
brandMilwaukee:channeleBay Sales	0.804129	0.153242	5.247	1.54E-07	***
brandPanasonic:channeleBay Sales	1.248048	0.224154	5.568	2.58E-08	***
brandPorter Cable:channeleBay Sales	-0.368066	0.171319	-2.148	0.031679	*
brandPowermatic:channeleBay Sales	1.095872	0.332125	3.3	9.68E-04	***
brandRidgid:channeleBay Sales	1.533381	0.168365	9.107	< 2e-16	***
brandRyobi:channeleBay Sales	1.715806	0.166299	10.318	< 2e-16	***
brandSenco:channeleBay Sales	1.149298	0.185288	6.203	5.55E-10	***
brandSkil:channeleBay Sales	0.586037	0.154629	3.79	0.000151	***
brandBlack & Decker:channelPhone	-0.595264	0.154038	-3.864	0.000111	***
brandBostitch:channelPhone	-0.096868	0.185322	-0.523	0.601184	
brandCampbell Hausfeld:channelPhone	-0.370222	0.164858	-2.246	0.024723	*
brandDelta:channelPhone	0.319053	0.194406	1.641	0.100763	
brandDewalt:channelPhone	-0.529781	0.152619	-3.471	0.000518	***
brandFein:channelPhone	-0.307907	0.198232	-1.553	1.20E-01	
brandFestool:channelPhone	0.046707	0.224432	0.208	0.835143	
brandHomelite:channelPhone	-0.409536	0.246077	-1.664	0.096061	.
brandJet:channelPhone	0.417561	0.240084	1.739	0.081994	.
brandKarcher:channelPhone	-0.363822	0.187381	-1.942	0.052184	.
brandMakita:channelPhone	-0.062341	0.148802	-0.419	0.675252	
brandMetabo:channelPhone	0.437339	0.19044	2.296	2.16E-02	*
brandMilwaukee:channelPhone	-0.183042	0.14892	-1.229	0.219022	
brandPanasonic:channelPhone	0.03291	0.203331	0.162	0.871419	
brandPorter Cable:channelPhone	-0.083768	0.150208	-0.558	0.577062	
brandPowermatic:channelPhone	1.188814	0.263673	4.509	6.52E-06	***
brandRidgid:channelPhone	-0.428436	0.167077	-2.564	0.010338	*

brandRyobi:channelPhone	-0.781916	0.169206	-4.621	3.82E-06	***
brandSenco:channelPhone	0.160296	0.175723	0.912	0.36166	
brandSkil:channelPhone	-0.400669	0.149885	-2.673	0.007514	**
brandBlack & Decker:ordered(inc).L	0.054144	0.085644	0.632	0.527261	
brandBostitch:ordered(inc).L	0.081323	0.10294	0.79	0.429527	
brandCampbell Hausfeld:ordered(inc).L	0.15084	0.095535	1.579	0.114359	
brandDelta:ordered(inc).L	0.136759	0.120535	1.135	0.256546	
brandDewalt:ordered(inc).L	0.075765	0.085408	0.887	0.375029	
brandFein:ordered(inc).L	-0.032393	0.120595	-0.269	0.788228	
brandFestool:ordered(inc).L	-0.036987	0.152583	-0.242	0.808468	
brandHomelite:ordered(inc).L	0.126704	0.131005	0.967	0.333462	
brandJet:ordered(inc).L	0.096537	0.139364	0.693	0.488499	
brandKarcher:ordered(inc).L	-0.110593	0.103601	-1.067	0.285749	
brandMakita:ordered(inc).L	0.066668	0.08516	0.783	0.433713	
brandMetabo:ordered(inc).L	0.273352	0.121288	2.254	0.024213	*
brandMilwaukee:ordered(inc).L	0.050461	0.083728	0.603	0.546724	
brandPanasonic:ordered(inc).L	0.136153	0.124873	1.09	0.275568	
brandPorter Cable:ordered(inc).L	0.112991	0.087224	1.295	0.19518	
brandPowermatic:ordered(inc).L	-0.159621	0.164534	-0.97	0.331976	
brandRidgid:ordered(inc).L	0.062906	0.091063	0.691	0.489694	
brandRyobi:ordered(inc).L	0.066408	0.092212	0.72	0.471421	
brandSenco:ordered(inc).L	0.085869	0.101563	0.845	0.397845	
brandSkil:ordered(inc).L	0.13014	0.084503	1.54	0.123545	
brandBlack & Decker:ordered(inc).Q	-0.090691	0.088355	-1.026	3.05E-01	
brandBostitch:ordered(inc).Q	0.128731	0.106651	1.207	0.227421	
brandCampbell Hausfeld:ordered(inc).Q	-0.01705	0.100066	-0.17	8.65E-01	
brandDelta:ordered(inc).Q	0.081546	0.126276	0.646	0.518425	
brandDewalt:ordered(inc).Q	0.283132	0.090353	3.134	1.73E-03	**
brandFein:ordered(inc).Q	-0.149323	0.125275	-1.192	2.33E-01	
brandFestool:ordered(inc).Q	-0.315734	0.149073	-2.118	3.42E-02	*
brandHomelite:ordered(inc).Q	0.031918	0.133996	0.238	0.811727	
brandJet:ordered(inc).Q	0.271626	0.145765	1.863	6.24E-02	.
brandKarcher:ordered(inc).Q	-0.366359	0.105046	-3.488	0.000487	***
brandMakita:ordered(inc).Q	0.08092	0.087871	0.921	3.57E-01	
brandMetabo:ordered(inc).Q	0.087904	0.128558	0.684	0.494123	
brandMilwaukee:ordered(inc).Q	0.260175	0.086852	2.996	2.74E-03	**
brandPanasonic:ordered(inc).Q	-0.024035	0.13346	-0.18	0.857083	
brandPorter Cable:ordered(inc).Q	0.115783	0.090635	1.277	0.20144	
brandPowermatic:ordered(inc).Q	0.136085	0.175919	0.774	0.439188	
brandRidgid:ordered(inc).Q	0.129681	0.098269	1.32	0.186949	
brandRyobi:ordered(inc).Q	-0.004645	0.095974	-0.048	0.961401	
brandSenco:ordered(inc).Q	0.267821	0.111221	2.408	1.60E-02	*
brandSkil:ordered(inc).Q	0.141293	0.088136	1.603	0.108906	

brandBlack & Decker:sexFemale	0.990301	0.120944	8.188	2.65E-16	***
brandBostitch:sexFemale	0.235018	0.149289	1.574	0.115431	
brandCampbell Hausfeld:sexFemale	0.391857	0.134894	2.905	0.003673	**
brandDelta:sexFemale	-0.183216	0.171861	-1.066	0.286391	
brandDewalt:sexFemale	0.126885	0.122138	1.039	0.298871	
brandFein:sexFemale	0.369436	0.168516	2.192	2.84E-02	*
brandFestool:sexFemale	-0.308035	0.205362	-1.5	0.133624	
brandHomelite:sexFemale	0.332505	0.188237	1.766	0.077326	.
brandJet:sexFemale	-0.371355	0.201993	-1.838	0.065996	.
brandKarcher:sexFemale	0.455684	0.147282	3.094	0.001975	**
brandMakita:sexFemale	0.163356	0.121237	1.347	0.177845	
brandMetabo:sexFemale	-0.030635	0.173766	-0.176	0.860056	
brandMilwaukee:sexFemale	-0.068785	0.11962	-0.575	0.565271	
brandPanasonic:sexFemale	-0.055627	0.173684	-0.32	0.748758	
brandPorter Cable:sexFemale	0.126443	0.124425	1.016	0.309525	
brandPowermatic:sexFemale	-0.815836	0.240427	-3.393	0.000691	***
brandRidgid:sexFemale	-0.009212	0.130631	-0.071	0.943781	
brandRyobi:sexFemale	0.367468	0.131242	2.8	0.005111	**
brandSenco:sexFemale	0.025625	0.14553	0.176	0.860228	
brandSkil:sexFemale	0.569505	0.120003	4.746	2.08E-06	***
brandBlack & Decker:sexNot Known	0.198516	0.122148	1.625	0.104118	
brandBostitch:sexNot Known	-0.006187	0.148109	-0.042	0.966679	
brandCampbell Hausfeld:sexNot Known	-0.004125	0.136865	-0.03	0.975954	
brandDelta:sexNot Known	-0.209137	0.171468	-1.22	0.222583	
brandDewalt:sexNot Known	-0.087868	0.122011	-0.72	0.471423	
brandFein:sexNot Known	0.008667	0.1703	0.051	0.959411	
brandFestool:sexNot Known	0.102434	0.201261	0.509	0.610779	
brandHomelite:sexNot Known	-0.048082	0.186803	-0.257	0.796872	
brandJet:sexNot Known	-0.140041	0.199847	-0.701	0.483464	
brandKarcher:sexNot Known	0.058267	0.148791	0.392	0.695349	
brandMakita:sexNot Known	0.094938	0.120299	0.789	0.430004	
brandMetabo:sexNot Known	0.176733	0.165476	1.068	0.285508	
brandMilwaukee:sexNot Known	-0.176813	0.118757	-1.489	0.136523	
brandPanasonic:sexNot Known	0.268847	0.165817	1.621	0.104942	
brandPorter Cable:sexNot Known	-0.222971	0.123399	-1.807	0.070777	.
brandPowermatic:sexNot Known	-0.436058	0.233165	-1.87	0.061461	.
brandRidgid:sexNot Known	-0.155358	0.130405	-1.191	0.233517	
brandRyobi:sexNot Known	0.030701	0.131651	0.233	0.815608	
brandSenco:sexNot Known	-0.160677	0.14677	-1.095	0.273627	
brandSkil:sexNot Known	-0.101525	0.121021	-0.839	0.401525	
brandBlack & Decker:cordlessNot Cordless	-1.383039	0.100497	-13.762	< 2e-16	***
brandBostitch:cordlessNot Cordless	NA	NA	NA	NA	
brandCampbell Hausfeld:cordlessNot Cordless	1.565218	0.128224	12.207	< 2e-16	***

brandDelta:cordlessNot Cordless	NA	NA	NA	NA	
brandDewalt:cordlessNot Cordless	-1.00721	0.100709	-10.001	< 2e-16	***
brandFein:cordlessNot Cordless	2.640616	0.244366	10.806	< 2e-16	***
brandFestool:cordlessNot Cordless	1.81401	0.210492	8.618	< 2e-16	***
brandHomelite:cordlessNot Cordless	NA	NA	NA	NA	
brandJet:cordlessNot Cordless	NA	NA	NA	NA	
brandKarcher:cordlessNot Cordless	2.737791	0.356577	7.678	1.62E-14	***
brandMakita:cordlessNot Cordless	-0.526343	0.099667	-5.281	1.28E-07	***
brandMetabo:cordlessNot Cordless	1.726152	0.203445	8.485	< 2e-16	***
brandMilwaukee:cordlessNot Cordless	-1.230661	0.098228	-12.529	< 2e-16	***
brandPanasonic:cordlessNot Cordless	-2.351996	0.137063	-17.16	< 2e-16	***
brandPorter Cable:cordlessNot Cordless	-0.128396	0.102877	-1.248	0.212012	
brandPowermatic:cordlessNot Cordless	NA	NA	NA	NA	
brandRidgid:cordlessNot Cordless	-1.15662	0.110212	-10.495	< 2e-16	***
brandRyobi:cordlessNot Cordless	1.04534	0.123895	8.437	< 2e-16	***
brandSenco:cordlessNot Cordless	0.874897	0.13418	6.52	7.02E-11	***
brandSkil:cordlessNot Cordless	0.068686	0.099919	0.687	0.491817	
brandBlack & Decker:condReconditioned	0.336607	0.101308	3.323	0.000892	***
brandBostitch:condReconditioned	0.934762	0.123307	7.581	3.44E-14	***
brandCampbell Hausfeld:condReconditioned	-0.295383	0.111687	-2.645	0.008175	**
brandDelta:condReconditioned	-2.026814	0.143395	-14.134	< 2e-16	***
brandDewalt:condReconditioned	-0.629044	0.100795	-6.241	4.35E-10	***
brandFein:condReconditioned	-1.971366	0.156764	-12.575	< 2e-16	***
brandFestool:condReconditioned	NA	NA	NA	NA	
brandHomelite:condReconditioned	6.697304	0.495862	13.506	< 2e-16	***
brandJet:condReconditioned	NA	NA	NA	NA	
brandKarcher:condReconditioned	0.433875	0.122933	3.529	0.000417	***
brandMakita:condReconditioned	0.213316	0.099651	2.141	3.23E-02	*
brandMetabo:condReconditioned	-2.015525	0.15413	-13.077	< 2e-16	***
brandMilwaukee:condReconditioned	-0.209517	0.098215	-2.133	0.032905	*
brandPanasonic:condReconditioned	-1.312138	0.139269	-9.422	< 2e-16	***
brandPorter Cable:condReconditioned	0.013779	0.103445	0.133	0.894036	
brandPowermatic:condReconditioned	NA	NA	NA	NA	
brandRidgid:condReconditioned	0.631481	0.111912	5.643	1.67E-08	***
brandRyobi:condReconditioned	2.090495	0.124782	16.753	< 2e-16	***
brandSenco:condReconditioned	0.757828	0.123308	6.146	7.96E-10	***
brandSkil:condReconditioned	0.229937	0.099534	2.31	2.09E-02	*
channelagg_channel:ordered(inc).L	0.093732	0.057304	1.636	1.02E-01	
channelAmazon Sales:ordered(inc).L	-0.01665	0.049441	-0.337	0.736302	
channeleBay Sales:ordered(inc).L	0.131704	0.052642	2.502	0.012354	*
channelPhone:ordered(inc).L	0.10703	0.050189	2.133	0.032962	*
channelagg_channel:ordered(inc).Q	-0.056519	0.061706	-0.916	0.359696	
channelAmazon Sales:ordered(inc).Q	-0.194782	0.05047	-3.859	0.000114	***

channeleBay Sales:ordered(inc).Q	0.394934	0.056678	6.968	3.21E-12	***
channelPhone:ordered(inc).Q	0.147269	0.052645	2.797	5.15E-03	**
channelagg_channel:sexFemale	-0.553004	0.083302	-6.639	3.17E-11	***
channelAmazon Sales:sexFemale	0.562195	0.069313	8.111	5.02E-16	***
channeleBay Sales:sexFemale	0.195726	0.075193	2.603	0.009242	**
channelPhone:sexFemale	-0.036688	0.070912	-0.517	0.604895	
channelagg_channel:sexNot Known	0.024818	0.080804	0.307	0.75874	
channelAmazon Sales:sexNot Known	0.510151	0.069851	7.303	2.81E-13	***
channeleBay Sales:sexNot Known	0.437712	0.075268	5.815	6.05E-09	***
channelPhone:sexNot Known	-0.053366	0.071804	-0.743	4.57E-01	
channelagg_channel:cordlessNot Cordless	-0.620028	0.077355	-8.015	1.10E-15	***
channelAmazon Sales:cordlessNot Cordless	-0.066871	0.065252	-1.025	0.305451	
channeleBay Sales:cordlessNot Cordless	-0.0254	0.0718	-0.354	0.723524	
channelPhone:cordlessNot Cordless	0.003316	0.067399	0.049	0.960762	
channelagg_channel:condReconditioned	1.411591	0.071485	19.747	< 2e-16	***
channelAmazon Sales:condReconditioned	0.940418	0.060727	15.486	< 2e-16	***
channeleBay Sales:condReconditioned	1.543654	0.065875	23.433	< 2e-16	***
channelPhone:condReconditioned	-0.1824	0.061901	-2.947	0.003212	**
ordered(inc).L:sexFemale	0.171197	0.040739	4.202	2.64E-05	***
ordered(inc).Q:sexFemale	0.208683	0.043794	4.765	1.89E-06	***
ordered(inc).L:sexNot Known	0.075262	0.041337	1.821	6.87E-02	.
ordered(inc).Q:sexNot Known	-0.039992	0.043141	-0.927	0.353925	
ordered(inc).L:condReconditioned	-0.016475	0.035746	-0.461	0.644871	
ordered(inc).Q:condReconditioned	0.121235	0.037967	3.193	0.001407	**
sexFemale:cordlessNot Cordless	-0.15221	0.054911	-2.772	0.005572	**
sexNot Known:cordlessNot Cordless	-0.102282	0.055358	-1.848	0.064651	.
sexFemale:condReconditioned	-0.489354	0.050805	-9.632	< 2e-16	***
sexNot Known:condReconditioned	-0.106814	0.050918	-2.098	0.035926	*
cordlessNot Cordless:condReconditioned	-0.469608	0.048931	-9.597	< 2e-16	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for poisson family taken to be 1)

Null deviance: 31161.3 on 2489 degrees of freedom
Residual deviance: 2132.1 on 2232 degrees of freedom
AIC: 4599.6

Number of Fisher Scoring iterations: 5